Nutrigenomics: Taking the first step in dietetics practice

4/13/18

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Assistant Professor, USC Keck School of Medicine and Leonard Davis School of Gerontology
Learning Objectives

By the end of the presentation participants will be able to:

1. Define nutrigenetics, nutrigenomics and epigenomics and their application to nutrition practice.
2. Locate genetic testing resources and understand cost and use.
3. Weigh the pros and cons of direct to consumer genetic testing (legal, ethical, confidentiality).
4. Discuss how consumer nutrigenomic data can potentially be applied, in select situations, to clinical dietetics practice for personalized diet planning.
• Gerontology – Study of the aging process
• Healthspan vs. Lifespan – live longer, healthier
• Health influences- genetics (family history), environment (chemicals, stress, sleep, food), disease exposure (viral, bacterial), accident/injury
• Prevention and early intervention- add to toolkit
• Genetic testing for common diagnoses – Alzheimer’s (APOE4), Breast Cancer (BRCA)
Start with the end in mind ........

What if ........

Epigenetics & Personal Health: Can We Control Our Own Future? | Matt Riemann | TEDxVeniceBeach 2015

https://www.youtube.com/watch?v=BZ3o5X2j3kY

Rosie the Maid Jetson’s
Early Adopters are Onboard

APP for Estimating Longevity

Insidetracker.com

Apple Smart Watch
- BP
- Heart
- Steps, laps
- Calories
- Pulse Oximeter

Diabetes patch and pump

USC Leonard Davis
School of Gerontology
Genetic Testing is here – Ancestry, Health, Disease, Medications
What if.... We could wear a sensor that told us what we needed to eat each day, each meal? Would we take more responsibility for our health? What information would we need to direct such a device? Are we there?
Core Knowledge and Competencies for the Registered Dietitian (6/1/2017)

KRDN 3.5 Describe basic concepts of nutritional genomics.

CDRnet.org
Nutritional Genomics in Practice: Where Do We Begin?

RUTH M. DEBUSK, PhD, RD; COLLEEN P. FOGARTY, MS, RD; JOSÉ M. ORDOVAS, PhD; KENNETH S. KORNMAN, PhD, DDS

Editor's note: This is the first in a series of articles on nutritional genomics. The series will appear periodically in the Journal, and is designed to address the educational, professional, and practical needs of the dietetics profession in this rapidly changing arena. Dr DeBusk and colleagues discuss the potential for nutrition genomics to enhance clinical practice, improve therapeutic outcomes, and significantly expand career and economic opportunities for practitioners. The future of dietetics is unquestionably intertwined with nutritional genomics.
Position of the Academy of Nutrition and Dietetics: Nutritional Genomics

ABSTRACT
It is the position of the Academy of Nutrition and Dietetics that nutritional genomics provides insight into how diet and genotype interactions affect phenotype. The practical application of nutritional genomics for complex chronic disease is an emerging science and the use of nutrigenetic testing to provide dietary advice is not ready for routine dietetics practice. Registered dietitian nutritionists need basic competency in genetics as a foundation for understanding nutritional genomics; proficiency requires advanced knowledge and skills. Unlike single-gene defects in which a mutation in a single gene results in a specific disorder, most chronic diseases, such as cardiovascular disease, diabetes, and cancer are multigenetic and multifactorial and therefore genetic mutations are only partially predictive of disease risk. Family history, biochemical parameters, and the presence of risk factors in individuals are relevant tools for personalizing dietary interventions. Direct-to-consumer genetic testing is not closely regulated in the United States and may not be accompanied by access to health care practitioners. Applying nutritional genomics in clinical practice through the use of genetic testing requires that registered dietitian nutritionists understand, interpret, and communicate complex test results in which the actual risk of developing a disease may not be known. The practical application of nutritional genomics in dietetics practice will require an evidence-based approach to validate that personalized recommendations result in health benefits to individuals and do not cause harm.


POSITION STATEMENT
It is the position of the Academy of Nutrition and Dietetics that nutritional genomics provides insight into how diet and genotype interactions affect phenotype. The practical application of nutritional genomics for complex chronic disease is an emerging science and the use of nutrigenetic testing to provide dietary advice is not ready for routine dietetics practice. Registered dietitian nutritionists need basic competency in genetics as a foundation for understanding nutritional genomics; proficiency requires advanced knowledge and skills.
Definitions

Epigenetics - the study of gene activity during the development of complex organisms. *Epigenetic* can be used to describe anything other than DNA sequence that influences the development of an organism. Variance in phenotype without change in DNA sequence.

Genome – The sum of all genetic material of an organism, includes genes.

Genomics – The study of genomes, composition, organization and their function.

Phenome – set of all phenotypes expressed by a cell, tissue, organ, or organism, examples of human phenotypic traits are skin color, eye color, height, taste variation, personality characteristics.

SNP – Single nucleotide polymorphism - phenotypic expression may be influenced by environmental influences, mutation, and genetic variation.
Definitions

**Nutrigenetics** - Impact of genetic differences between individuals on the response to dietary intake and the ultimate influence on health status and disease risk. Example: 5, 10-∗methylene-tetrahydrofolate reductase (MTHFR) gene. Mutations result in enzyme activity Folate -> 5 methyl folate

**Nutrigenomics** - The interactions between bioactive components in food and the genome and the resulting changes in proteins and other metabolites that affect gene expression. Examples: HTN- Salt; Caffiene – CVD; PKU, MMU, MSUD

**Epigenomics** - the study of the complete set of epigenetic modifications on the genetic material of a cell, known as the epigenome.

**Omic** - informally, related to a field of study in biology. Example – proteomics, metabolomics, genomics.
Epigenetic mechanisms are affected by development in utero and in childhood, environmental chemicals, drugs and pharmaceuticals, aging, and diet. DNA methylation is what occurs when methyl groups can tag DNA and activate or repress genes. Histones are proteins around which DNA can wind for compaction and gene regulation. All of these factors and processes can have an effect on people’s health possibly resulting in cancer, autoimmune disease, mental disorders, or diabetes among other illnesses. 

National Institutes of Health
The Agouti gene, makes mice fat & yellow when not silenced. When silenced in pups of vitamin-dosed mothers results in a healthy brown mouse. (discovered 1994)

Epigenetic mechanisms include chromatin folding and attachment to the nuclear matrix, packaging of DNA around nucleosomes, covalent modifications of histone tails (e.g. acetylation, methylation, phosphorylation), and DNA methylation. The influence of regulatory small RNAs and micro RNAs on gene transcription is also increasingly recognized as a key mechanism of epigenetic gene regulation. Culprits: bisphenol A, deficiency of methyl-related nutrients include folate, methionine, Vitamin B12 and Vitamin B6.

Mom given folic acid & choline before, during and after pregnancy, the animals gave birth to thin, brown pups. Gene silenced.
How Much do we Need?

Each individual may require a different level of nutrients because of their unique set of genetic variations.
Start with Direct to Consumer Tests for Genetic & SNP Analysis:
• 23 and Me $ 199, includes ancestry and health info.
• Ancestry.com $ 99 (less on Father’s day, $ 79) only provides ancestry matching, raw data can be downloaded
• Promethease.com, used raw genetic data compared to NIH research, defining SNP risk $ 5-10
• SNPedia - a Wiki investigating human genetics. Information about the effects of variations in DNA, citing peer-reviewed scientific publications.
• Disease-Specific Companies defining risk for specific conditions, look at only limited SNPs, often need to be reviewed by MD
• Full genome evaluation (~ $ 1,000)
23 & Me

• Educator resources for classroom teaching
• Discount on test kits for students
• Consumer friendly navigation and results
• FDA limits what they can share without MD involvement, gradually new information
• Can tell you carrier status for Genetically inherited conditions
Patrick Kreutzer

100%

European
100%

Northwestern European
92.7%

British & Irish
39.6%

French & German
34.1%

Scandinavian
1.9%

Broadly Northwestern European
17.0%

Southern European
4.2%

Iberian
1.8%

Italian
1.1%

Sardinian
0.3%

Broadly Southern European
1.0%

Eastern European
1.0%

Broadly European
2.1%
Carrier Status Reports

These reports tell you about variants that may not affect your health, but could affect the health of your future family. For the conditions included in these reports, a person can be a carrier even if they don’t have a personal or family history of the disease.

View Carrier Status Tutorial

About “Variant not detected”

You may see “Variant not detected” for many reports. What does that mean?

If you see “Variant not detected” for a Carrier Status report, it means you’re not a carrier of the tested variant(s). Keep in mind that while our Carrier Status reports cover many variants, they don’t include all possible variants associated with each condition. So it’s still possible to be a carrier of a variant not included in our test. Learn more.

- ARSACS
  Variant not detected

- Agenesis of the Corpus Callosum with Peripheral Neuropathy
  Variant not detected

- Autosomal Recessive Polycystic Kidney Disease
  Variant not detected
Healthy Habits for Your Genetics

We looked at 23andMe research participants with a genetic weight predisposition like yours and found certain lifestyle factors that were associated with the biggest weight differences.

These habits made the biggest difference in people with your genetics:

1. Limiting red meat
   - People at a healthy weight ate red meat less than 2 times per week, on average.
   - People who never ate red meat weighed up to 12.1% less than those who ate red meat every day.

2. Avoiding fast food
   - People at a healthy weight ate fast food less than once per week, on average.
   - People who never ate fast food weighed up to 11.3% less than those who ate fast food almost every day or more.

3. Sleeping a healthy amount
   - Associated with weighing up to 11.1% less
Ancestry.com
- Look for ancestors and create family tree
- Download raw Data
AncestryDNA raw data download

This file was generated by AncestryDNA at: 09/21/2016 17:09:47 MDT
Data was collected using AncestryDNA array version: V1.0
Data is formatted using AncestryDNA converter version: V1.0
Below is a text version of your DNA file from Ancestry.com DNA, LLC. THIS INFORMATION IS FOR YOUR PERSONAL USE AND IS INTENDED FOR GENEALOGICAL RESEARCH ONLY. IT IS NOT INTENDED FOR MEDICAL OR HEALTH PURPOSES. THE EXPORTED DATA IS SUBJECT TO THE AncestryDNA TERMS AND CONDITIONS, BUT PLEASE BE AWARE THAT THE DOWNLOADED DATA WILL NO LONGER BE PROTECTED BY OUR SECURITY MEASURES.
WHEN YOU DOWNLOAD YOUR RAW DNA DATA, YOU ASSUME ALL RISK OF STORING, SECURING AND PROTECTING YOUR DATA. FOR MORE INFORMATION, SEE ANCESTRYDNA FAQS.

Genetic data is provided below as five TAB delimited columns. Each line corresponds to a SNP. Column one provides the SNP identifier (rsID where #possible).
Columns two and three contain the chromosome and basepair position of the SNP using human reference build 37.1 coordinates. Columns four and five contain the two alleles observed at this SNP (genotype). The genotype is reported on the forward (+) strand with respect to the human reference.

<table>
<thead>
<tr>
<th>rsid</th>
<th>chromosome</th>
<th>position</th>
<th>allele1</th>
<th>allele2</th>
</tr>
</thead>
<tbody>
<tr>
<td>rs4477212</td>
<td>1</td>
<td>82154</td>
<td>T</td>
<td>T</td>
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<tr>
<td>rs3131972</td>
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<td>752721</td>
<td>A</td>
<td>G</td>
</tr>
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<td>rs12562034</td>
<td>1</td>
<td>768448</td>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>rs11240777</td>
<td>1</td>
<td>798959</td>
<td>A</td>
<td>G</td>
</tr>
</tbody>
</table>
Promethease is a literature retrieval system that builds a personal DNA report based on connecting a file of DNA genotypes to the scientific findings cited in SNPedia.

Biomedical researchers, healthcare practitioners and customers of DNA testing services (such as 23andMe, Ancestry.com, FamilyTreeDNA, Genos, etc.) use Promethease to retrieve information published about their DNA variations. Most reports cost $5 and are produced in under 10 minutes. Much larger data files (such as imputed full genomes from dna.land) cost $10 and have increased runtime.

Your report will remain anonymous, but here are some sample reports
- 23andMe Sample1
- 23andMe Sample2
- Ancestry.com Sample1
- Ancestry.com Sample2
- Ancestry.com Sample3 (older platform)
- Ancestry.com Sample4 (older platform)
- FamilyTreeDNA Sample1
- FamilyTreeDNA Sample2
- Genos Sample1
SNPedia is a wiki investigating human genetics. We share information about the effects of variations in DNA, citing peer-reviewed scientific publications. It is used by Promethease to create a personal report linking your DNA variations to the information published about them. Please see the SNPedia:FAQ for answers to common questions.

BROWSE

genes
genotypes
genosets
medical conditions
medicines
topics
Carrier of one CYP1A2*1F allele; Slow Caffeine Metabolizer. One copy of the slow caffeine metabolizer SNP and one copy of the fast version. This makes you more strongly affected by drinking coffee, as caffeine is broken down slower in the liver. Supposedly this increases the risk of heart attacks, although other studies show caffeine is generally good for the heart. It also makes caffeine more effective at preventing Breast Cancer, Alzheimer’s Disease, and Parkinson’s disease. Too much caffeine will shrivel your breasts.

rs762551, also known as -164A>C or -163C>A, is a SNP encoding the CYP1A2*1F allele of the CYP1A2 gene. For historic reasons, the rs762551(C) allele is considered the wild-type, even though it is the rarer allele in most populations. The rs762551(A) allele is the “fast metabolizer” allele known as CYP1A2*1F; the (C) allele is by comparison a slower metabolizer of certain substrates (including caffeine). In terms of genotypes, only rs762551(AA) individuals are considered fast metabolizers. Individuals who are rs762551(A/C) heterozygotes or rs762551(CC) homozygotes are both considered slow metabolizers. The CYP1A2 gene encodes a member of the cytochrome p450 family of proteins, which metabolize nutrients and drugs. One well known substrate of CYP1A2 is caffeine; individuals who are carry one or more CYP1A2*1C alleles are “slow” caffeine metabolizers, whereas carriers of the variant CYP1A2*1F are “fast” caffeine metabolizers. The same amount of caffeine will therefore tend to have more stimulating effect on CYP1A2 slow metabolizers than on CYP1A2 fast metabolizers. A study of healthy premenopausal non-hormone using women concluded that drinkers of 3 or more cups of...
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A study of healthy premenopausal non-hormone using women concluded that drinkers of 3 or more cups of coffee per day tended to have lower breast volume (smaller breasts), but only if they had at least one rs762551(C) allele (p(interaction)=0.02), which was said to be consistent with reports that coffee protects only C-allele carriers against breast cancer. [PMID 18813311]

Another study by the same group looked at coffee consumption as related to breast cancer. Among 458 such patients (age 25-99 years), rs762551(A:A) women (about 1/2 of the total study) who drank 2 or more cups of coffee per day tended to have a later age at diagnosis compared with low coffee consumption (59.8 versus 52.6 years, p = 0.004). These patients were also more likely to have ER- tumors than patients with low consumption (14.7% versus 0%, p = 0.018). Coffee consumption had no associations in carriers of a rs762551(C) allele [PMID 18398030].

An independent study of 411 BRCA1 mutation carriers (170 cases and 241 controls) looked at the association between breast cancer, coffee consumption before age 35, and CYP1A2 genotype. While CYP1A2 genotype did not affect breast cancer risk, women with at least one rs762551(C) allele who consumed coffee had a 64%
Folic Acid

rs1801133(C;T)
1 copy of C677T allele of MTHFR = 65% efficiency in processing folic acid. It is found in approximately:
- 48% of Hispanic Americans
- 45% of Caucasian Americans
- 45% of Japanese
- 57% of Germans
- 29% of Asians
- 24% of African Americans
- 12% of Sub-Saharan Africans

rs1801133 is a SNP that is relatively common and has been studied for (relatively) a long time. Also known as C677T, Ala222Val, and A222V, it encodes a variant in the MTHFR gene, which encodes an enzyme involved in folate drug metabolism. Homozygous rs1801133(C;T) individuals have ~30% of the expected MTHFR enzyme activity, and rs1801133(C,T) heterozygotes have ~65% activity, compared to the most common genotype, rs1801133(C,C). *Our Take on The MTHFR Gene* is a 23andMe blog posting (January 5, 2017), a meta-analysis finding that the past two decades of scientific evidence as it relates to specific MTHFR-influenced health conditions to be inconclusive or conflicting, with two exceptions, 1. women with two copies of C677T variant, 2. a very rare variant that may cause homocystinuria. Their takeaway, *Based on the existing data, scientists at 23andMe have concluded that people should not interpret their genotypes at the common MTHFR variants as having an effect on their health.* This reduced activity (i.e. this SNP) has been linked at least once to each of the following disorders (though not necessarily reproducibly):...
rs1801133

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This reduced activity (i.e. this SNP) has been linked at least once to each of the following disorders (though not necessarily reproducibly):

- autism
- cancer, including gastric cancer and lung cancer

<table>
<thead>
<tr>
<th>Geno</th>
<th>Mag</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>(C,C)</td>
<td>0</td>
<td>Common genotype: normal homocysteine levels</td>
</tr>
<tr>
<td>(C,T)</td>
<td>2.2</td>
<td>1 copy of C677T allele of MTHFR = 65% efficiency in processing folic acid</td>
</tr>
<tr>
<td>(T,T)</td>
<td>2.8</td>
<td>Homozygous for C677T of MTHFR = 10-20% efficiency in processing folic acid = high homocysteine, low B12 and folate levels</td>
</tr>
</tbody>
</table>

Reference: GRCh38 38:1/141
Chromosome: 1
Position: 11796321
Medications

Promethease

Main Blood PGx

rs2032583(T;T)

7x less likely to respond to certain antidepressants. This version of a blood brain barrier protein blocks many common antidepressants from entering the brain, including: amitriptyline (Elavil), citalopram (Celexa), paroxetine (Paxil), and venlafaxine (Effexor). That makes those antidepressants 7 times less effective.

rs2032583 is a SNP in the ABCB1 gene (also known as the MDR1 gene), which encodes a protein that transports certain molecules across the blood-brain barrier. SNPs in ABCB1 may thus influence the intracerebral concentrations of certain drugs and thus their efficacy or potential for adverse side effects.

rs2032583 is one of 9 SNPs found within a tight linkage block (r^2 ~ 0.8) such that the minor allele at any one of them predicts (with ~80%+ accuracy) that the other SNPs will also be the minor allele. The list of the 9 SNPs is shown below. When treated for depression with substrates of the protein encoded by ABCB1, carriers of one or two minor alleles at these ABCB1 SNPs have been reported to respond better than non-carriers. The antidepressant drugs that are known to be substrates include...

[Image of genetic analysis tool]

USC Leonard Davis School of Gerontology

University of Southern California
myBRCA

A simple screening test to help you understand your risk for hereditary breast and ovarian cancer. Order now for $199.
What do you get?

A Report
A report with your results

Genetic Counseling
A complimentary call with one of our genetic counselors to review your results upon request (currently applies to US only)

Valuable Insights
Insights to help you and your doctor determine the most appropriate breast and ovarian cancer prevention strategies based on your risk

How to get started

1. Order the test
   Order the test on our website and we will get in touch with your doctor for their approval

2. Receive a kit
   We'll mail you a saliva collection kit to easily collect your sample

3. Sample is processed
   Once we receive your sample, we process it at our CLIA lab and provide results within 6-8 weeks

4. Your report is ready
   We let you and your doctor know that your results are ready on our secure site
Wellness starts with your story. And that story starts with what you want.

We connect your genetics, 80+ health markers, and gut diversity to understand your wellness like never before.

You work with a personal coach, a licensed health care professional, to translate this knowledge into meaningful lifestyle changes.

What do you want to achieve? Your coach will create an action plan completely personalized to your body and goals.

How it Works
Information for Healthcare Professionals

Nutrigenomix Inc. is a biotechnology company founded by some of the global leaders in nutrigenomics research. We are dedicated to empowering healthcare professionals and their patients with comprehensive, reliable, cutting-edge genomic information with the ultimate goal of improving health through personal nutrition. Our Nutrigenomix test kit enables healthcare professionals to counsel individuals according to their DNA, which creates an avenue to personalized nutrition. Nutrigenomix provides you with a new and powerful technology to add to your portfolio of skills as a healthcare professional.

Join the exciting era of genomics and personalized nutrition by making Nutrigenomix a part of your practice today.

Become an authorized provider of Nutrigenomix®

Register Now
Download Brochure
The answer may be in your genes

In 480 BC, Hippocrates noted that “positive health requires knowledge of man’s primary constitution”. This was just an ancient way of saying that we cannot achieve optimum health without knowing about our genes. We now know that specific variations in our genes can explain how we will respond to the foods, beverages and supplements we consume.

Learn how your genes can affect:

- Cardio-metabolic Health
- Nutrient Metabolism
- Weight Management
- Food Intolerances
- Eating Habits
- Physical Activity
- Injury Risk

USC Leonard Davis
School of Gerontology

University of Southern California
# Summary of Results

## Nutrient Metabolism

<table>
<thead>
<tr>
<th>Dietary Component</th>
<th>Gene, rs Number</th>
<th>Risk Variant</th>
<th>Your Variant</th>
<th>Your Risk</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>BCMO1, rs11645428</td>
<td>GG</td>
<td>AA</td>
<td>Typical</td>
<td>Meet the RDA for vitamin A daily.</td>
</tr>
<tr>
<td>Vitamin B₁₂</td>
<td>FUT2, rs601338</td>
<td>GG or GA</td>
<td>GA</td>
<td>Elevated</td>
<td>Focus on consuming bioavailable sources of vitamin B₁₂.</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>GSTT1, rs2266633</td>
<td>Del</td>
<td>Ins</td>
<td>Typical</td>
<td>Meet the RDA for vitamin C daily.</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>CYP2R1, rs10741657</td>
<td>Algorithm</td>
<td>AA</td>
<td>Elevated</td>
<td>Consume 1000 IU (25 mcg) vitamin D daily.</td>
</tr>
<tr>
<td></td>
<td>GC, rs2282679</td>
<td></td>
<td>G G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin E</td>
<td>F5, rs8025</td>
<td>CT or TT</td>
<td>CC</td>
<td>Typical</td>
<td>Meet the RDA for vitamin E daily.</td>
</tr>
<tr>
<td>Folate</td>
<td>MTHFR, rs1801133</td>
<td>CT or TT</td>
<td>CC</td>
<td>Typical</td>
<td>Meet the RDA for folate daily.</td>
</tr>
<tr>
<td>Iron Overload</td>
<td>SLC17A1, rs17342717</td>
<td>Algorithm</td>
<td>CC</td>
<td>Typical</td>
<td>Follow the recommendations provided in the Low Iron Status section.</td>
</tr>
<tr>
<td></td>
<td>HFE, rs1800562</td>
<td></td>
<td>G G</td>
<td></td>
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GERO 518 Topics in Clinical Nutrition – Assignments

• Confidentiality Waiver Completed (required by University)
• Each student completes 23 and Me or Ancestry saliva test; analyzes their data using Promethease
• Student writes reflection on use of genetic data in understanding disease and the role of nutrition
• Student completes literature review and presents abstract of findings and PPT presentation to class
Genetics and Diet

- Cardiovascular disease
- Inflammatory disorders
- Immune health and cancer
- Blood sugar regulation
- Bone mineralization
- Weight management
- Chronic diseases
Each student selects a SNP of interest from their Promethease report (or will select from the list provided by the professor) where nutrition potentially plays a role in SNP activation or protective non-activation (e.g., folate metabolism, diabetes, obesity, macular degeneration, caffeine, heart disease).

Students conduct a literature review for their defined SNP and evaluate the evidence presented in the literature, focus on the strengths of the evidence.
1. Perilipin1 (PLIN1) Meal Timing and Weight Loss
2. Type 1 Diabetes & Celiac Disease [rs3184504 (T,T)]
3. MTHFR C677T Folate & Depression and Colorectal Cancer
4. MDRI/ABCB1 Cancer Risk
5. NAT2/C282T Chemical Detoxification & Cancer Risk
6. rs2282679 Low Vitamin D Levels and Colorectal Cancer Risk
7. CTEP (rs5882) Aging, Longevity and Alzheimer’s Disease
8. TAS2R38 ((rs10246939, rs1726866, rs713598) Taste Perception
9. FUT2 gene and Vitamin B12 Status (rs602662, rs601338)
10. FTO (rs9939609) Obesity and Type 2 Diabetes and Physical Activity; Ghrelin and Obesity
11. Caffeine Metabolism CYP1A2 (rs762551)
12. AGT Gene and M235T (rs699) and Hypertension (HTN)
Example: Clinical Nutrition Application
RDN and MD

While Risk is UNCLEAR for many SNPs – General Guidelines Can be Given

**Good News**
- Healthy kidney function
- Fast metabolizer of caffeine, less stimulated
- Decrease risk for post-operative nausea
- No alcohol flush, body is able to break down acetaldehyde
Example: General Concerns

**Cardiometabolic**
- Slight risk for cardiovascular disease
- Slight risk for hypertension, atrial fibrillation, and/or ischemic stroke
- Slight risk for Type 2 diabetes

**Oncogenic**
Increase risk for prostate cancer
Risk for lung cancer if a smoker

**Other**
Poor ability to metabolize folate, missing adequate amount of enzyme, so poor absorption
Slight increase risk for Alzheimer's disease (APOe 3 + 4)
Example: Clinical Nutrition Recommendations

- Review genetic data with your primary physician.
- Regularly review laboratory data including lipid panel, hsCRP, HgA1C; Recommend a target of total cholesterol below 180; Recommend a target HgbA1c below 5.2 – consider various diet and exercise approaches.
- Monitor blood pressure, treat as needed – recommend a target of systolic blood pressure of 120 mm HG.
- Mediterranean Diet: Minimize meat and dairy, increase plant-based foods; include Olive Oil, nuts, regular fish intake.
- Increase intake of natural phytochemicals (berries, vegetables, other fruits).
- Reduce stress through yoga, meditation, music.
- Optimize sleep.
- Exercise at least 30-60 minutes per day.
Dear Colleague,

The International Society of Nutrigenetics/Nutrigenomics (ISNN) was established in 2005, under the Presidency of Artemis P. Simopoulos, MD (USA).

It is the purpose of the Society to increase the understanding of the role of genetic variation and individual dietary response, and the role of nutrients in gene expression generally. This purpose is pursued through research and education of professionals and the general public.

The Aims of the Society shall be achieved through:

a. promoting research on the role of genetic variation and dietary response and the role of nutrients in gene expression;

b. defining the relationship between genes and nutrients from basic biology to clinical states. This encompasses the areas of (1) genetic variation and dietary response, (2) nutrients in gene expression, and (3) the role of genes in the determination of nutritional requirements;

c. establishing a Network of Centers on Genetics, Nutrition and Health worldwide;

d. encouraging the development of programs for genetics and nutrition in departments of nutrition and genetics, and in schools of public health and medicine;

e. serving as a clearing-house for the media in disseminating facts regarding the role of genetic variation and dietary response and the role of nutrients in gene expression;
International Society of Nutrigenomics and Nutrigenetics (ISNN)
ISNN Membership Application/Renewal

The annual membership fee includes a subscription to *Journal of Nutrigenetics and Nutrigenomics* (JNN), the official journal of the ISNN. You will receive an order confirmation with your password and user ID by mail in the next few days.

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Legal, Ethical, Confidentiality

1. Not to be taken lightly, what if?
2. If data are not used now could they be used in future?
3. How can you protect your data?
4. What will you do with the information?
Genetic Information Nondiscrimination Act (GINA) 2008

• Ensures that Americans will not be discriminated against with respect to employment and health insurance.
• California Genetic Information Nondiscrimination Act (CalGINA)(2011)
Next Steps

• Spit, Explore, Learn
• Apply – in addition to existing assessment measures
• Exercise caution
• [link](https://enroll.23andme.com/research/global-genetics/identity/) (research study)
• Cracking Your Genetic Code (2015) NOVA
• Ghost in Your Genes (2007) (ihavenotv.com) NOVA
• Amed El-Sohemy, PhD, U of Toronto, and Nutrigenomix [link](https://www.youtube.com/watch?v=JhDZ3F4rkiQ&t=1064s) - Do Our Genes Determine What We Should Eat?

**POSITION STATEMENT**

It is the position of the Academy of Nutrition and Dietetics that nutritional genomics provides insight into how diet and genotype interactions affect phenotype. The practical application of nutritional genomics for complex chronic disease is an emerging science and the use of nutrigenetic testing to provide dietary advice is not ready for routine dietetics practice. Registered dietitian nutritionists need basic competency in genetics as a foundation for understanding nutritional genomics; proficiency requires advanced knowledge and skills.

2014
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