Exclusive Webinar Presentation

Applying Nutrigenomics in Clinical Practice:

The Nuts and Bolts

Earn 1 CPEU

Presented by Sheila Dean, DSc, RDN, LDN, CCN, CDE, IFMCP on Tuesday, June 26, 2018 from 2:00-3:00pm ET

Disclosure

- Co-founder of the Integrative and Functional Nutrition Academy™
- IFNA™ is an Accredited Provider of CPEUs by the CDR
- IFNA™ offers the IFNCP™, Integrative and Functional Nutrition Certified Practitioner Advanced Practice Credential

3 key objectives:

1. To define what nutritional genomics is generally about to the extent that we understand at this time

2. To identify how our unique genes affect our nutritional needs

3. To identify how food affects the way these unique genes of ours express themselves

Human Genome Project

- An international research effort begun in the 1980s to map and sequence about 30,000 genes found in the human species and then finally completed in 2003, two years ahead of schedule.
- The outcome?

4

A Deepened Understanding Of:

- Genomics – the study of genes and their function
- Epigenetics – how environment controls gene activity
  - Nutritional genomics – how nutrients affect gene expression
  - Pharmacogenomics – how drugs affect gene expression

5

Nutritional Genomics or "Nutrigenomics":

- Using nutrients (and other natural factors) to serve as "dietary signals" to modify gene expression, the making of proteins, and metabolic function.

Simply put:

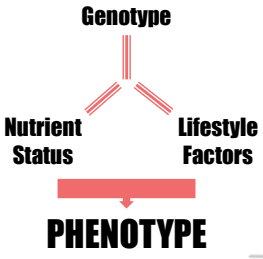
Gene x Nutrient

interactions

6

Gene ~ Environment Interaction

The interplay between genetic inheritance and the environment is a major factor that determines propensity towards disease or health.



7

NutriGenomics

Diet is the most important environmental factor influencing expression of genetic information because of the constant exposure to food.

JADA. April 2005 pg 589-598.

8

TIME Magazine

January 18, 2010

"It is these epigenetic marks that tell your genes to switch on or off, to speak loudly or whisper."

9

Chromosomes, histones and methyl groups

- Chromosomes → histones that act as spools around which the DNA winds→"epigenetic marks"/methyl groups on the CpG island → gene silencing
- The CpG sites or CG sites are regions of DNA where a cytosine nucleotide occurs next to a guanine nucleotide in the linear sequence of bases along its length.

10

The Nutrigenomic Paradigm

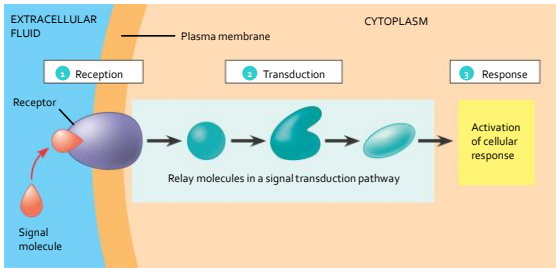
GENOME: The Story of the Most Astonishing Scientific Adventure of Our Time – The Attempt to Map All the Genes in the Human Body

"Genes in and of themselves do not create disease. Only when they are plunged into a harmful environment unique to the individual do they create the outcome of disease".

11

Cell Communication—How it Works

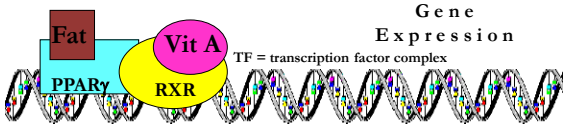
- Overview of cell signaling



Used with permission: Biology 11th ed, Pearson

12

Gene X Environment



PPARγ and RXR are transcription factors

Outcome

Used with permission: Ruth Debusk, PhD, RD

13

Stressed Foods – Are We Eating More Than We Think?

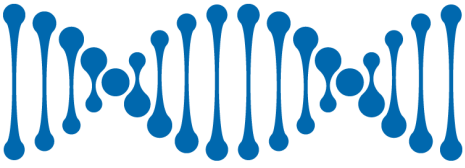
"Obese livestock and unusual fat profiles in farmed fish, meat and eggs may reflect stress phenotypes. Consumers of stressed foods may sense those signals and assume the stressed phenotype. This maladaptive process may promote obesity toward caloric accumulation in the context of energy abundance. Regional tissue accumulation of fat may indicate local tissue stress. Atherosclerosis may result from *stress signals* that induce sympathetic bias and regional fat accumulation in vessel adventitia. Medications such as neuroleptics and foods such as diet drinks may generate *illegitimate signals* by mimicking molecules used for energy management…"

Yun AJ, et. al. Med Hypotheses. 2006; 67 (1):360

14

Nutrition and Epigenetics

Miki Tokunaga, Toru Takahashi, Ram B. Singh, Fabien De Meester, Douglas W. Wilson
Med Epigenet 2013; 1:70-77



15

NutriGenomic Profile: Genes and Diet	
APOE2	Lower Carbohydrate, Alcohol
APOE3	Lower calorie, Soluble fiber, Alcohol for women (neutral for men)
APOE4	Low Fat, No Cholesterol, Soluble Fiber Alcohol for women, No Alcohol for men
CETP	Alcohol Mederterranean Diet (Low sat. fat; high olive oil, fish, and fiber)
AGT	Low Salt Diet
MTHFR	5-methyl THF, Folate, B2, B12, B6
VDR	Vitamin D
COL1A1	Calcium- higher dose with more frequent dosing
IL1-β	Fish Oils, HCl, Nettle Leaf
IL-6	Fish Oils, Siberian Ginsing, Zinc, NAC, Vitamin E, CLA, beta-sitosterol for acutes DHEA (other steroids, E, P, and T)
TNF-α	Fish Oils, Nettle Leaf, NAC, Green Tea

16

CYP1A1	Avoid grilled and well-cooked foods Eat Brassica and Allium Foods Use only DIM (no IC3) Resveratrol – Red Wine Do Not Smoke
CYP1B1	Avoid grilled and well-cooked foods Eat Brassica and Allium Foods Fish Oils IC3 or DIM Resveratrol – Red Wine DHEA
GNB3	Increased risk of metabolic syndrome and obesity
COMT	Adequate B6, B12, folate, magnesium, and methionine to prevent elevated homocysteine Antioxidants to prevent oxidation of pro-carcinogenic 4-OHestrogens
GSTM1	Antioxidants Greatest benefit from Brassica, Allium, or Apiaceous vegetables depending on genotype and gender
GSTP1	Antioxidants
SOD2	Antioxidants
SELE	Decrease NF-κB activation via vitamins E & C, NAC, milk thistle, green tea

17

How Dietary Polyphenols Interfere with Oxidative Stress-triggered Signaling

- Oxidative stress induces inflammation by triggering→ NF-κB activation (a major proinflammatory cytokine) which affects a wide variety of cellular signaling processes leading to generation of inflammatory mediators such as the expression of pro-inflammatory genes such as:
  - IL-1β
  - IL-8
  - TNFα

- On the flip side, to counter the effects of oxidative stress, the cells are also going to express → protective antioxidant genes such as MnSOD (Mn super oxide dismutase).

- Polyphenols and flavonoids inhibit pro-inflammatory gene expression by:
  1. downregulating proinflammatory cytokines such as NF-κB and "silencing" these genes via histone deacetylation so the DNA condenses and does not allow expression of the gene.
  2. expression of antioxidant genes are upregulated.

Rahman I, Biswas SK, Kirkham PA. Regulation of inflammation and redox signaling by dietary polyphenols. Biochem Pharmacol. 2006;72:1439-1452.

18

Food Has "Personality"

- In a study that put subjects on two different diets of exactly the same number of calories and carb grams, the diet that contained high glycemic carbs had in increase in inflammatory markers. (via needle biopsy, they did a gene array on subject fat tissue and found an upregulation of inflammatory and stress genes)
- "Dietary carbohydrate modification with rye and pasta (↓GI) vs oat, wheat and potato (↑GI) differentially modulates the gene expression profile in abdominal subcutaneous adipose tissue, even in the absence of weight loss".

Kallio, P. Am J Clin Nutrition May 2007; 85: 1417-27.

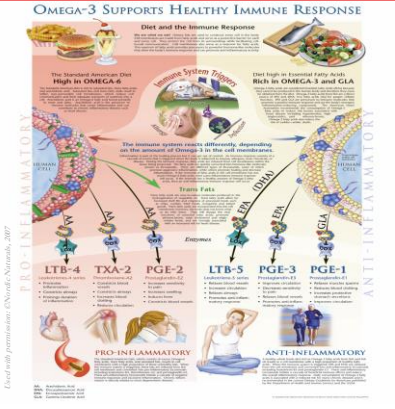
19

FOOD IS INFORMATION!

- Food has the ability to act as signals or molecules of informational messages that your genes then translate into proteins.
- What kind of messages do you want to expose your genes to?
  - Messages of health?
  - Messages of disease?

20

Messages of disease vs. Messages of health



21

Standard American Diet = SAD

- Refined sugar
- Refined flour
- Preservatives
- Additives
- Pesticides
- Hormones
- Trans fats
- Animal protein
- Caffeine
- Alcohol
- Artificial chemicals/sweeteners/fats

22

Genetic "Language"

- The genetic code is specified by the four nucleotide "letters":
  - A (adenine),
  - C (cytosine),
  - T (thymine),
  - G (guanine).
- What happens when a single nucleotide, such as an A, replaces one of the other three nucleotide letters: C, G, or T ???

23

Single Nucleotide Polymorphisms (SNPs)

A T G G T A A G C C T G A G C T G A C T T
A T G G T A A A C C T G A G T T G A C T T
↑ ↑
SNP SNP

- A SNP (aka *gene variant*) that is caused by a change in a single nucleotide.
- Any protein can have a SNP! – important!!

24

Single Nucleotides Polymorphisms - SNPs

- Single base mutation in DNA
- Most simple form of genetic polymorphism
- SNP's occur in greater than 1% of the population. We all have millions (about 3) of SNP's!
- There are 15 million locations where SNP's can occur/occur 0.5-10 per every 1000 base pairs
- SNPs are associated with almost all diseases.

Source: DeBusk, R. Genetics: The Nutrition Connection. 2003

25

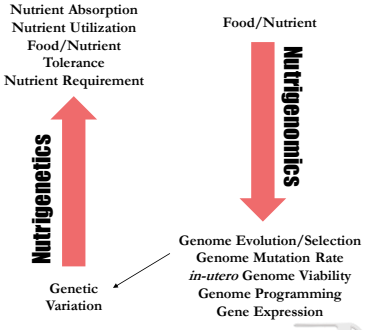
Diet → Genes → Metabolism → Function

Key Points:

- Everyone has the same genes in slightly different versions, called "gene variants" or "SNPs".
- It's these variations that distinguish one person from another.
- Different variations (gene variants) lead to different metabolism and function between individuals (+,-,N) due to different nutrient requirements and effects on gene variants.

26

Nutrigenetics vs. Nutrigenomics



Stover, P et al. JADA. 2006;108:1480-1487

27

MTHFR
An Example Of A Common SNP

3 possible outcomes:

-/- Normal or "wild-type"

-/+ Heterozygous for the SNP

+/+ Homozygous for the SNP

28

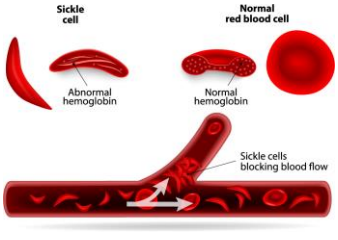
The 5 Major Methylation Pathway Cycles

29

Variations Within Variations

MTHFR -low penetrance, high frequency variation

Sickle Cell Anemia – high penetrance, low frequency



30

Gene Polymorphism

Each gene is composed of 2 alleles which may be:

- the same ~ homozygous ~ **AA** or **aa**

or

- different ~ heterozygous ~ **Aa**

However, there may be more than 2 allele variants {polymorphisms} ~

e.g: **APO E2, APO E3, APO E4**

Thus a person's APO E genotype may be:

E2/E2, E2/E3, E2/E4

E3/E3, E3/E4, E4/E4

6 different genotypes possible

ApoE4 gene, Alzheimer's & Type 3 Diabetes

- ↑ CVD risk
- ↑ Alzheimer's ("Type 3 Diabetes") risk – 5x
  - Alzheimer's beta-amyloid peptide specifically interacts with and is degraded by insulin degrading enzyme (IDE)
  - Check fasting insulin (3-9)
  - IDE clears both insulin and amyloid beta plaques in the brain

Percentage of APO E Genotypes in the General Population		
Apo E 2	2/2	1%
	2/3	10%
Apo E 3	3/3	64%
Apo E 4	4/2	2%
	4/3	18%
	4/4	5%

Alzheimer's Disease Is Type 3 Diabetes – Evidence Reviewed

Journal of Diabetes Science and Technology

Volume 2 Issue 6, November 2008

We conclude that the term "type 3 diabetes" accurately reflects the fact that AD represents a form of diabetes that selectively involves the brain and has molecular and biochemical features that overlap with both type 1 diabetes mellitus and T2DM.

Journal Diabetes Science & Tech, 2008

Multi-Genetic Disease/Genes express in "families"

More often, multiple polymorphisms and/or haplotypes interact to:

- ➔ modify nutrient demand and metabolism
  - affect enzyme production and efficiency
- ➔ alter epigenetic regulatory mechanisms
  - cytokines, hormones, sensor molecules and transcription factors
  - Ppars, MAP kinases, NF-Kappa-B
- ➔ modulate expression of other genes
  - further alters metabolism and regulatory elements
- ➔ change responses to environmental factors
  - nutrition, exercise, xenobiotics

Leads to development of disease phenotype
Hypertension, coronary heart disease, Type 2 diabetes

High-dose vitamin therapy stimulates variant enzymes with decreased coenzyme binding affinity (increaded K): relevance to genetic disease and polymorphisms

Bruce N. Ames, Han Elson-Schwab, and Eli A Silver

"Our analysis of metabolic disease that affects cofactor binding , particularly as a result of polymorphic mutations, may present a novel rationale for high dose vitamin therapy, perhaps hundreds of times the normal dietary reference intake in some cases."

Ames, AJCN. 2002;75:616-658.

Gene-nutrition for enzyme polymorphism

Many polymorphic gene-regulated enzymes display exhibit reduced cofactor or coenzyme binding

- About 30% of the 1000 disease phenotypes related to SNP polymorphisms reportedly exhibit reduced specific enzyme binding
- At least 50 diseases have been shown to respond to high-dose nutrient supplements
  - Vitamin B1, Vitamin B2, Vitamin B3, Vitamin B5, Vitamin B6
  - Vitamin B12, Folic acid, Biotin
  - Vitamin E, Vitamin K, Vitamin D
  - Lipoic acid, Carnitine, SAMe, Tetrahydrobiopterin
  - Amino acids: alanine, serine, glycine, isoleucine
  - Minerals: zinc, copper, selenium, potassium
  - Ascorbic acid

Ames et al, 2002.

Ruth Debusk, Ph.D, R.D.

It's Not Just Your Genes. BKDR Publications, 2006.

"Even if you carry gene variants that mark you as being susceptible to a complex disease, the variants alone won't make you ill. They do increase the risk that a disease will develop ***in the presence of certain behaviors…"***

37

Methylation SNPs

38

CBS – Cystathionine Beta-Synthase

- CBS initiates the trans-sulfuration pathway, converting homocysteine in to cystathionine and its downstream metabolites.
- One of the most important methyl cycle defects
- C699T snp upregulates CBS 10-fold
- Excess Ammonia production
- Excess Sulfite/Sulfate production

Reference: Prudova et al, 2006

39

Diseases Related to Poor Folate Metabolism

- Spina bifida and other NTDs
- Depression, Anxiety, OCD
- Alzheimer's
- Cognitive Decline
- Heart Disease and Stroke
  - Elevated homocysteine
- Cancer
- Poor detoxification

40

MTHFR Research

American Journal of Clinical Nutrition

Vol. 88, No. 5, 1413-1418, November 2008

- **ORIGINAL RESEARCH COMMUNICATION**
- **Risk of colorectal cancer associated with the C677T polymorphism in 5,10-methylenetetrahydrofolate reductase in Portugue… methyl-…**
- **Catarin… Susana … Fidalgo … and Ma…**
- **Backgr…** involvec… methyl-… colorect…
- **Objecti…** genetic p… (methylene tetrahydrofolate reductase), A2756G *MTR* (methionine synthase), and C1420T *SHMT* (serine hydroxymethyltransferase)] with the intake of methyl-donor nutrients in CRC risk.

"High intake of folate (>406.7 µg/d) was associated with a significantly lower risk of CRC.. homozygous participants for the C677T *MTHFR* variant (TT) showed a 3.0-fold increased risk of CRC.."

- **Design:** Patients with CRC (*n* = 196) and healthy controls (*n* = 200) matched for age and sex were evaluated for intake of methyl-donor nutrients and the 3 polymorphisms.
- **Results:** Except for folate intake, which was significantly lower in patients ($P = 0.02$), no differences were observed in the dietary intake of other methyl-donor nutrients between groups. High intake of folate (>406.7 µg/d) was associated with a significantly lower risk of CRC (odds ratio: 0.67; 95% CI: 0.45, 0.99). The A2756G *MTR* polymorphism was not associated with the risk of developing CRC. In contrast, homozygosity for the … fold … ism also … ables … rients was … ozygous … m, but a … ved for … *MT*
- **Conclusion:** These results show an association between the C677T *MTHFR* variant and different folate intakes on risk of CRC.

41

Contribution of the MTHFR gene to the causal pathway for depression, anxiety and cognitive impairment in later life.

Neurobiol Aging

Almeida OP, Flicker L, Lautenschlager NT, Leedman P, Vasikaran S, van Bockxmeer FM.

2005 Feb;26(2):251-7.

"Subjects with the TT genotype have higher homocysteine levels and may be particularly prone to experiencing depression as a result of high plasma Hcy and dysfunction of methylation metabolic pathways critical to the synthesis of noradrenaline and serotonin."

PMID: 15582752 [PubMed - indexed for MEDLINE]

42

The 677 C/T MTHFR polymorphism is associated with essential hypertension, coronary artery disease, and higher homocysteine levels.

Arch Med Res. 2008 Jan;39(1):125-30. Epub 2007 Oct 15.
Ilhan N, Kucuksu M, Kaman D, Ilhan N, Ozbay Y.

"The TT genotype of the 677C/T MTHFR polymorphism is associated with EH and CAD. In addition, TT genotypes had higher plasma Hcy levels in CAD patients compared with CC and CT genotypes."

43

Agouti Mice

Randy Jirtle, 2000
Duke University

With no more than a change in diet, laboratory agouti mice were prompted to give birth to young that differed markedly in appearance and disease susceptibility.

44

Mexican Pima Indians: Now & Then

45

"Thrifty Gene" Theory – The Survival Advantage

- Those who have "thrifty genes" can survive in conditions of famine and scarcity because their genes allow them to build up fat during times of "feasting" or times of plenty so as to avoid starvation during famine.
- With a shift to the SAD diet, food has become abundant year round. So the same genes that saved our ancestors from starvation now put us at a disadvantage because they are exposed to "too much of too little". That is too many calories of very little nutritional quality.

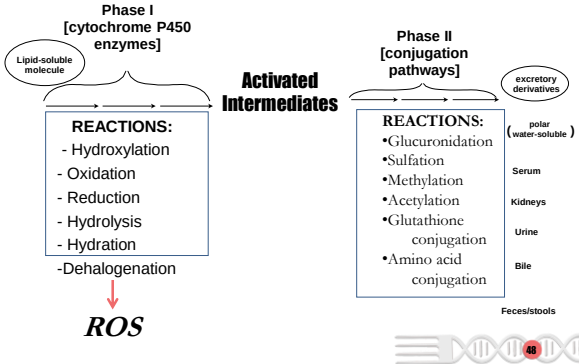
46

Diseases Related to Poor Folate Metabolism

- Spina bifida and other NTDs
- Depression, Anxiety, OCD
- Alzheimer's
- Cognitive Decline
- Heart Disease and Stroke
  - Elevated homocysteine
- Cancer
- Poor detoxification

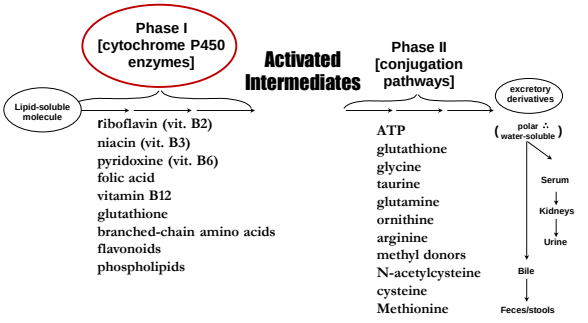
47

Reactions Involved in Detoxification Pathways



48

Supportive Nutrients for Detoxification Pathways



49

Genetic factors contribute to the ability to clear toxins

Interpatient variability: genetic predisposition and other genetic factors.
J Clin Pharmacol
West WL, Knight EM, Pradhan S, Hinds TS.
1997;37(7):635-48.

"Research identifies significant genetic variation in CYP450 Phase I enzyme expression in humans. *These variations have a significant impact on the patients ability to clear toxins."*

50

CYP2D6 Genotyping as an Alternative to Phenotyping for Determination of metabolic Status in a Clinical Trial Setting

AAPS PharmSci. 2000;2(4):E33.
McElroy S1, Sachse C, Brockmoller J, Richmond J, Lira M, Friedman D, Roots I, Silber BM, Milos PM.

"The research objectives of this study were to assess the utility of cytochrome P450 2D6 (CYP 2D6) genotyping as a predictor of poor metabolizer status..Our results suggest that CYP2D6 genotyping is a valid alternative to traditional phenotyping in a clinical trial setting and in some cases may be better".

51

Sample Report may include…

- CYP1A1
- CYP1B1
- CYP2A6
- CYP2C9
- CYP2C19
- CYP2D6
- CYP3A4

COMT – Catechol O-methyl Transferase

Result	Gene	SNP Location	Affects
+ -	COMT	V158M	Liver/Gut

Key:
- - Neither chromosome carries the genetic variation - "wild type"
+ - One chromosome (of two) carries the genetic variation – Heterozygous positive
+ + Both chromosomes carry the genetic variaton – Homozygous positive

COMT - Estrogen metabolism

- E1 – Estrone
  - 2, 4, 16 estrones
- E2 – Estradiol
- E3 – Estriol

- E1→ →→2/4 hydroxyestrone→→→2/4 methyoxyestrone

Phase 2 – COMT (Mg dependent)

Glutathione s-transferase

Result	Gene	Location	Affects
Present	GST M1	1p13.3	Liver/Kidney
- -	GST P1	I105V	Brain/Skin
- +	GST P1	A114V	Brain/Skin

Key:
- - Neither chromosome carries the genetic variation - "wild type"
+ - One chromosome (of two) carries the genetic variation – Heterozygous positive
+ + Both chromosomes carry the genetic variaton – Homozygous positive

SOD – Superoxide Dismutase

Result	Gene	SNP Location	Affects
- -	SOD1	G39A	Cytosol
- -	SOD1	A4V	Cytosol
+ -	SOD2	A16V	Mitochondria

Key:
- - Neither chromosome carries the genetic variation - "wild type"
+ - One chromosome (of two) carries the genetic variation – Heterozygous positive
+ + Both chromosomes carry the genetic variaton – Homozygous positive

4th Leading Cause Of Death Is…

- According to article by JAMA an estimated 2,216,000 (1,721,000 to 2,711,000) hospitalized patients had serious adverse drug reactions (ADRs) and 106,000 (76,000 to 137,000) had fatal ADRs, *making these reactions between the fourth and sixth leading cause of death.*
- Today that statistic is being quoted as closer to the third leading cause of death.
- This means that patients that received the correct doses of the correct drugs administered by the proper health care professional still had so many ADR's that it is a leading cause of DEATH!

Source: JAMA. April 15, 1998;279(15):1200-5

WHY Is This Happening?

- "***Any factor*** that alters pharmacokinetics or pharmacodynamics could be responsible for adverse drug events."
  - Gladson. Pharmacology for Physical Therapists, pg 47
- What does this mean?
- Biochemical Individuality and Genetic Uniqueness

Glutathione S-transferase M1, P1, T1

Gene	What Does the Gene Do?	Genetic Variation Detected	Do You Have the Variation?	What Does This Mean For You?	
GSTM1	The GSTM1 gene is involved in the second phase of detoxification, helping to remove toxins from the body through sweat and urine.	Deletion (Del)	Yes Your Result: (deleted)	Detoxification:	You do not have a working copy of the GSTM1 gene, which means that you may have reduced detoxification capacity.
GSTP1	The GSTP1 gene is another gene involved in the second phase of detoxification.	Ile 105Val Other names for this variation: 313 A>G, Rs1695	No Your Result: (A,A)	Detoxification:	You do not have SNP at position 313 of the GSTP1 gene- no gene specific recommendations required
		Ala114Val Other names for this variation: 341 C>T, rs1138272	No Your Result: (C,C)	Detoxification:	You do not have a SNP at position 341 of the GSTP1 gene- no gene specific recommendations required.
GSTT1	The GSTT1 gene is also involved in the second phase of detoxification	Deletion (Del)	Yes Your Result: (Deleted)	Detoxification:	You do not have a working copy of the GSTT1 gene, which means that you may have reduced detoxification capacity.

How Do You Evaluate/Interpret This? Look At The Big Picture!

Who? When? What? Why? The Patients Story!

- Pattern analysis
- Looking at nutrigenetic trends
- Patient diagnosis
- Family history
- Clinical symptoms
- Traditional blood work
- Urine chemistries
- Functional labs
- Readiness to change
- Financial resources

61

Health benefits of fruit and vegetables are from additive and synergistic combinations of phytochemicals

Rai Hai Lin

"Regular consumption of fruit and vegetables is associated with reduced risks of cancer, cardiovascular disease, stroke, Alzheimer disease, cataracts, and some of the functional declines associated with aging…. We propose that the additive and synergistic effects of phytochemicals in fruit and vegetables are responsible for their potent antioxidant and anticancer activities, and that the benefit of a diet rich in fruit and vegetables is attributed to the complex mixture of phytochemicals present in whole foods."

62

Patient comes to see you…

- 61 y.o. happily married female
- 2 adult children, professionals and 2 grandchildren
- Attorney, definitely Type A
- Diffuse family hx of CA, no clear pattern or type
- Overweight, BMI 29
- hsCRP ↑
- Most parameters WNL but on high side of normal:
  - Cholesterol, LDL, slightly low HDL
  - BG
  - BP
- Rx: HRT, zolpidem prn and tagamet prn
- Short on time
- Eats out regularly for lunch and dinner
- Diet high in fat and glycemic load, low in fiber
- Likes fruits and vegetables but doesn't take time to prepare
- Drinks socially
- Exercises occasionally/inconsistent
- HER GOALS:

  Make changes to reduce risk of developing cancer, increase energy, weight loss

63

Nutrigenetic Analysis

Antioxidant Defense

SOD2	–	–
SOD3	+	–

Detoxification, Phase I

CYP1A1	+	+
CYP1A2	+	–

Methylation

MTHFR	+	–

Detoxification, Phase II

GSTM1	+	+
GSTP1	–	–

– = Usual + = Variant

Nutrigenetic Analysis

Cancer Risk Factor	Gene	SNPs	Genotype
Detoxification, Phase I	*CYP1A1*	2453 A>G	**GG**
	CYP1A2	-163 A>C	**AC**
Detoxification, Phase II	*GSTM1*	Ins/Del	**Del/Del**
	GSTP1	313 A>G	**AA**
Antioxidation	*SOD2*	-28 C>T	**CC**
	SOD3	670 C>G	**CG**
Methylation	*MTHFR*	677 C>T	**CT**

What Would Your Advice To This Patient Be?

Basic Nutrition Support

- Diet primarily plant-based (organic)
- Low to moderate fat (high fat yields lipid peroxides)
- Lean protein, minimum well-cooked/grilled meats
- Whole grain foods/methylated B vitamin supplements
- Antioxidant-rich foods/supplements
- Mineral-rich foods/supplements
- Thiol/sulfer-rich foods
- Probiotics for healthy gut microflora of appropriate mix
- High fiber: soluble and insoluble
- Omega-3 fats (high quality)
- Calorie and carb controlled

Basic Nutrition Support (cont.)

- Maximize Phase II activity

- 2 major approaches:
  - ↑ intake of polyphenols, especially flavonoids

  - ↑ intake of glucosinolates
    - Whole foods such as cruciferous vegetables
    - Functional foods such as Brocco Sprouts and Brassica teas

Best Food Choices

Antioxidants	Fruit/vegetable-rich foods
B2, B3, B6, B12, folate	Whole grains, oranges/juice, dark green leafy vegetables, dried beans and peas
Cruciferous/thiol rich vegetables	Broccoli, Brussels sprouts, cabbage, cauliflower, kale, watercress
Fiber	Dried beans/peas, fruits, vegetables, oats, barley, brown rice, whole grains
Flavonoid-rich	Red/purple/black fruits/juice, tomatoes, green/black teas, red wine, garlic, onions
Mineral-rich	Nuts, whole grains, green leafy vegetables
Omega-3 fats	Cold-water oily fish, ground flax, omega-3 enriched eggs, certain oils

Putting It All Together…

- **Diet**
  - Calorie-controlled, low glycemic load
  - Organic, plant-based whole food diet
  - Lots of polyphenol-rich fruits, vegetables, soy
  - Work on incorporating cruciferous/allium veggies to ↑ phase II and support estrogen metabolism
  - Reduce/eliminate caffeine, smoked/chargrilled protein, nitrites
  - Probiotics and prebiotics
  - Increase omega-3s to reduce inflammation
  - Consider dietary supplements to support various strategic targets
- **Lifestyle**
  - Reduce weight to desirable level (esp. inflammation)
  - Incorporate regular physical activity
  - Manage stress—numerous suggestions here, including making time for friends, down time just for her
  - Avoid tobacco, exhaust fumes
  - Toxin-free cleaning products, ↓ volatile organics

Some Of The Labs/Companies That Offer Nutrigenetic Testing

- Those I've worked with:
  - Genova Diagnostics – gdx.net
  - Berkeley Heart Panel → Quest Labs
  - Gene SNP→ Market America
  - 23andMe → National Genomics, Lab Corp, available DTC. No longer offers health related genetic reports; only uninterpreted raw genetic data and ancestry- related genetic reports.
    - 23andMe Gene app still available https://livewello.com/23andme
  - DNAlysis
  - Genoma International
  - Nutrigenomix

So What We See Is That Nutrigenetic Testing:

- Can explain/confirm patient diagnosis, symptomology, and other data (ie labs) that you already have. It's just one tool in your toolkit
- Identifies the patients "weakest links"
- Can be used as a "behavioral tool" to help with patient compliance
- Can be very useful in the prevention of ADR's and many useful drug applications (i.e. chemo)
- Key NGX panels include:
  - Methylation
  - Detoxigenomic
  - Cardiovascular

Take Home Message

✓It's not about any one SNP or single magic food

✓Nutrigenetic testing is just one piece of the patients story to help you build a more solid nutrition care plan

✓Aim for pattern recognition and trend analysis

✓Avoid determinant statements about the influence of gene variants on disease outcome.

Image credit: Regina Brigelius-Flohe, Wiley-VCH

Other resources and training for the 21st century Integrative Practitioner

- Dietitians in Integrative and Functional Medicine Certificate of Online Training
  - www.integrativerd.org

- Integrative and Functional Nutrition Academy Advanced Practice Credential - IFNCP™
  - www.IFNAcademy.com

INTEGRATIVE AND FUNCTIONAL NUTRITION ACADEMY™

Recommended References

- Nielsen D., El-Sohemy A. A Randomized Trial of Genetic Information for Personalized Nutrition. *Genes Nutr.* 2012; 7(4):559-566.
- Szarc vel Szic, et al. Nature or Nurture: Let food be your epigenetic medicine in chronic inflammatory disorders. *Biochemical Pharmacology*. 2010; 80:1816-1832.
- DeBusk RM. Diet-Related Disease, Nutritional Genomics, and Food and Nutrition Professionals *J Am Diet Assoc.* 2009;109(3):410-413.
- Boehl T. Emerging Science Raises Questions: What to Tell Your Clients about Nutritional Genomics. *J Am Diet Assoc.* 2007;107(7):1094-1096.
- DeBusk RM, Fogarty CP, Ordovas JM, Kornman KS. Nutritional Genomics in Practice: Where Do We Begin? *J Am Diet Assoc.* 2005;105:589-598.

Other web based references:
- ncbi.nlm.nih.gov/genome
- cdc.gov/genomics

It's not just your genes,

it's what you bathe them in over a lifetime!

Image credit with permission: Ruth DeBusk, PhD, RD

76

More questions?
Contact me via www.IFNAcademy.com

77

Credit Claiming

You must complete a brief evaluation of the program in order to obtain your certificate. The evaluation will be available for one year; you do not need to complete it on June 26, 2018.

Credit Claiming Instructions:

1. Go to **CE.TodaysDietitian.com/Nutrigenomics OR** log on to **CE.TodaysDietitian.com**, go to "My Courses" and click on the webinar title.
2. Click "Take Course" on the webinar description page.
3. Select "Start/Resume Course" to complete and submit the evaluation.
4. Download and print your certificate.

78