Is Genetic Testing for Personalized Nutrition Ready for Prime Time?

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London – Sydney

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Disclosure

A. E-S. is Founder & CSO and holds shares in Nutrigenomix Inc.

What do the skeptics say?

www.businessinsider.com/personalized-nutrition-dietary-advice-dna-test-microbiome-2017-6

BUSINESS INSIDER SCIENCE

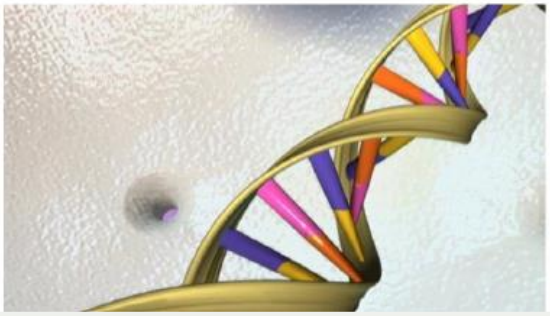
Companies are trying to use your DNA and bacteria to give you personalized diet advice – here's what the science says

Kevin Loria
Jun. 11, 2017, 2:36 PM 9,446

FACEBOOK LINKEDIN TWITTER EMAIL PRINT

In our never-ending quest to get healthy, there's a constant, nagging hope that we'll find a hidden key to fitness — some trick or piece of information that finally makes it easy to look and feel how we want.

That's why bizarre diets take off and nutrition "breakthroughs"



www.nutraingredients.com/Research/Rogue-operators-undermining-growing-field-of-personalised-r

'Rogue operators' undermining growing field of personalised nutrition, warns nutrigenomics author

By David Anderson, 15-Jun-2017 Post a comment

Secure | https://geneticliteracyproject.org/2016/09/23/nutrigenomics-can-custom-diets-based-personal-genetics-help

GENETIC LITERACY PROJECT
SCIENCE NOT IDEOLOGY

ABOUT HUMAN FOOD & AGRICULTURE SPECIAL SECTIONS RESOURCES

Nutrigenomics: Can custom diets based on personal genetics help you lose weight?

Meredith Knight | September 23, 2016 | Genetic Literacy Project

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Your genes say eat your greens,

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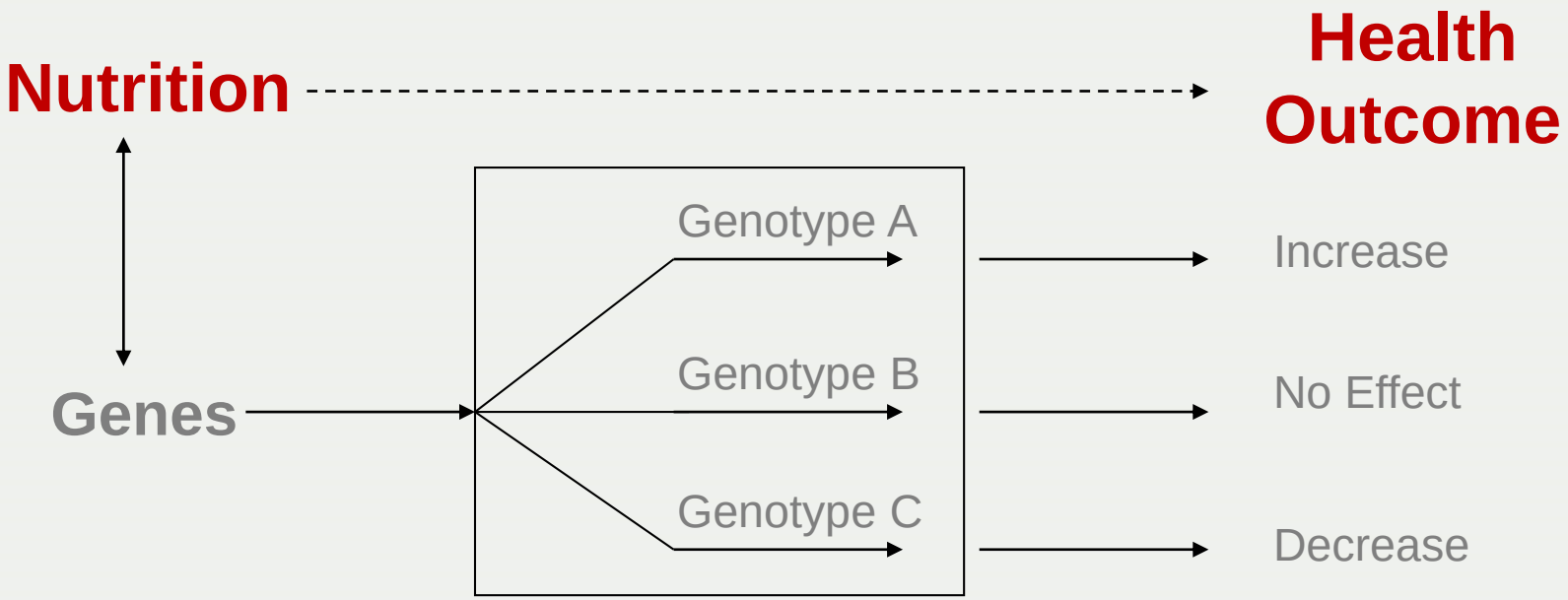
Genetic Testing

Disease Risk Genes

vs

Metabolic/Modifier Genes

Why are genetic differences important for nutrition?



One size does not fit all

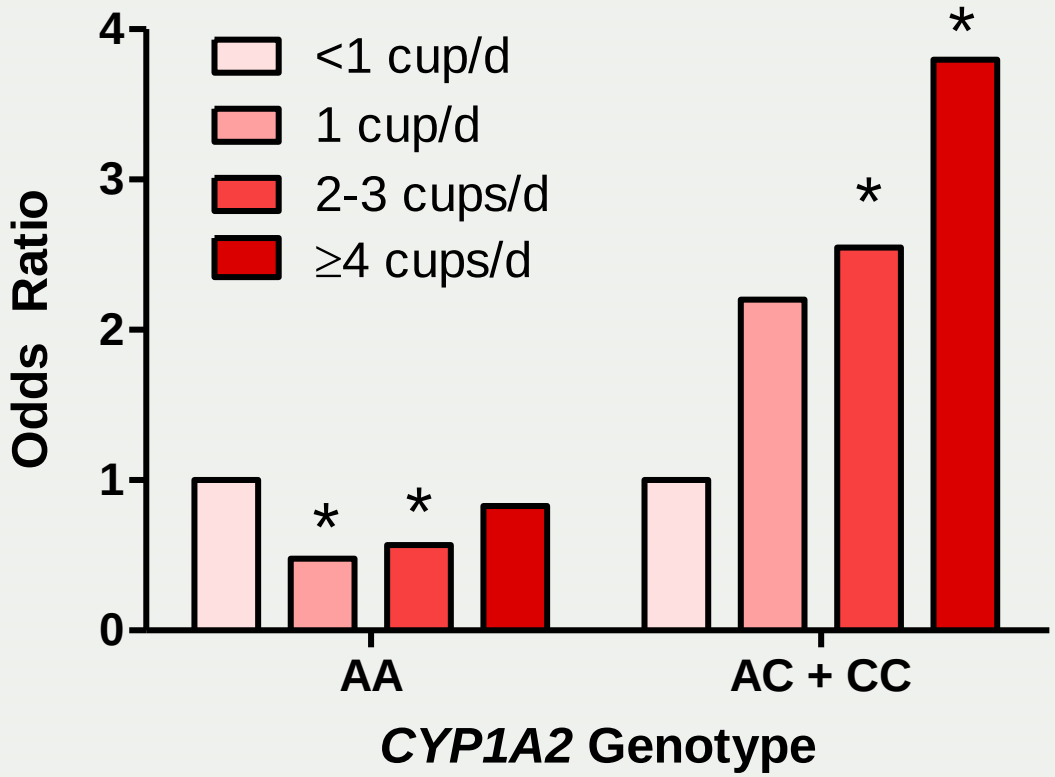
Coffee Intake and Risk of Myocardial Infarction

Coffee, CYP1A2 Genotype, and Risk of Myocardial Infarction

Marilyn C. Cornelis, BSc
Ahmed El-Sohemy, PhD
Edmond K. Kabagambe, PhD
Hannia Campos, PhD

JAMA. 2006;295:1135-1141

Coffee Intake and Risk of Myocardial Infarction



* P<0.05

Cornelis *et al*., JAMA 295: 1135-41, 2006

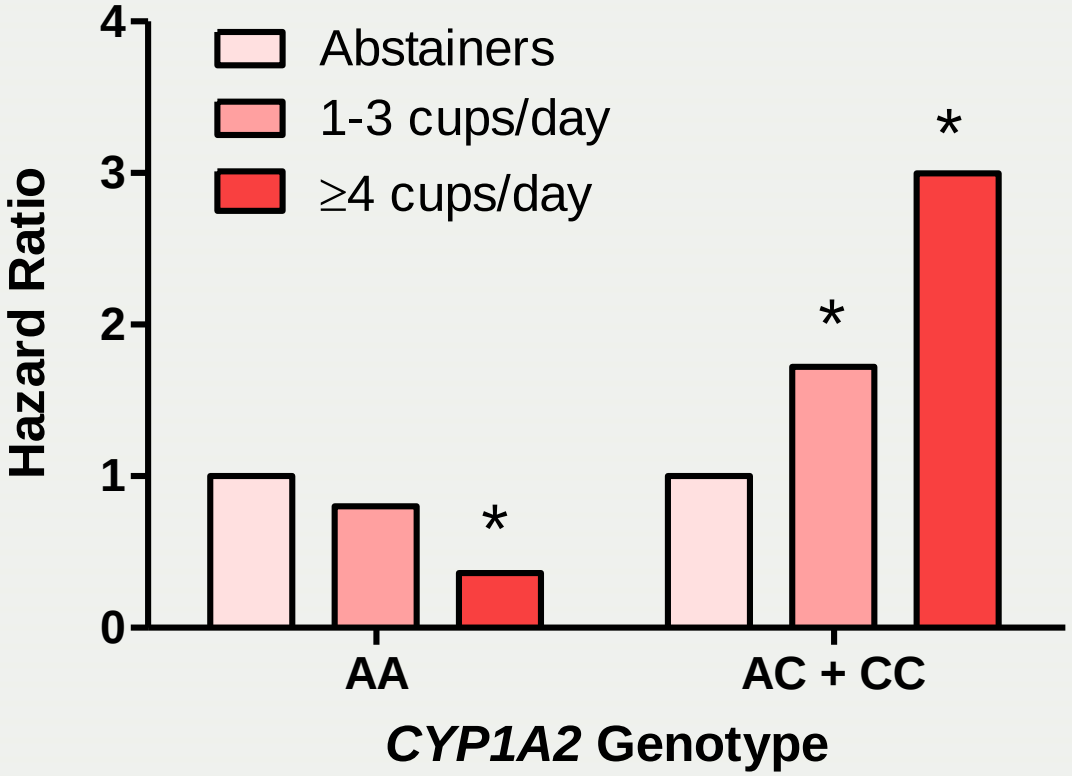
Replication: Risk of Hypertension

CYP1A2 genotype modifies the association between coffee intake and the risk of hypertension

Paolo Palatini[a], Giulio Ceolotto[a], Fabio Ragazzo[a], Francesca Dorigatti[a], Francesca Saladini[a], Italia Papparella[a], Lucio Mos[b], Giuseppe Zanata[c] and Massimo Santonastaso[d]

Journal of Hypertension 2009, **27**:1594–1601

Replication: Risk of Hypertension



*P<0.05

Palatini *et al*., J Hypertens 27: 1594-1601, 2009

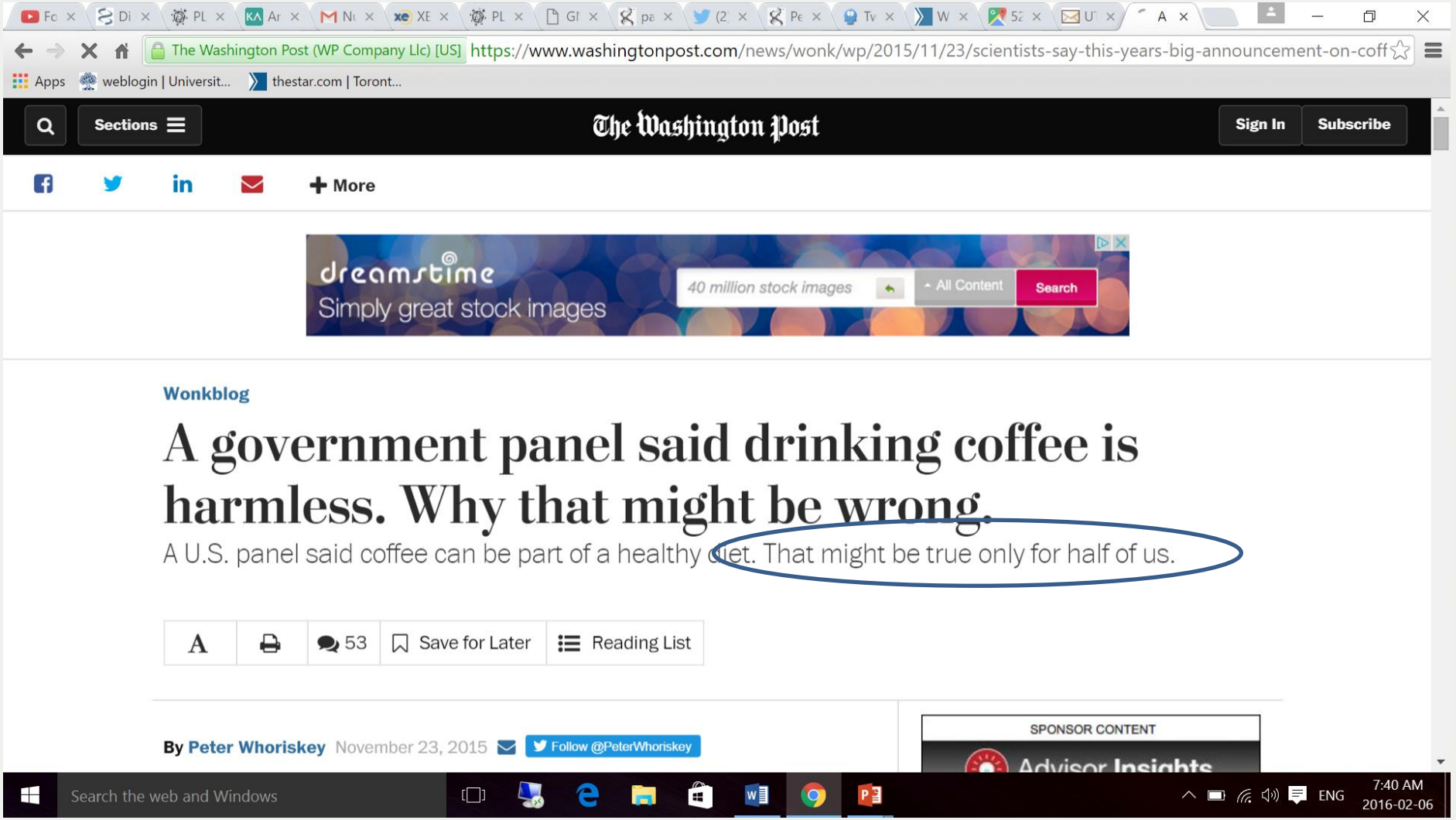
Replication: Risk of Pre-Diabetes

Eur J Epidemiol (2015) 30:209–217
DOI 10.1007/s10654-015-9990-z

CARDIOVASCULAR DISEASE

Association of coffee consumption and CYP1A2 polymorphism with risk of impaired fasting glucose in hypertensive patients

Paolo Palatini · Elisabetta Benetti · Lucio Mos · Guido Garavelli · Adriano Mazzer · Susanna Cozzio · Claudio Fania · Edoardo Casiglia


The Washington Post (WP Company Llc) [US] https://www.washingtonpost.com/news/wonk/wp/2015/11/23/scientists-say-this-years-big-announcement-on-coff
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A government panel said drinking coffee is harmless. Why that might be wrong.
A U.S. panel said coffee can be part of a healthy diet. That might be true only for half of us.
53
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2016-02-06

“There are spectacular metabolic differences in people, and to expect that coffee will have the same health effects on everyone is absurd,”

- Dr. Sander Greenland
  Professor Emeritus, Epidemiology
  UCLA

“Unfortunately, because genetic testing is expensive and rarely done, most people have little idea which gene variant they carry.”

- Panel Member

RESEARCH

OPEN ACCESS

Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes

Robin Poole,[1] Oliver J Kennedy,[1] Paul Roderick,[1] Jonathan A Fallowfield,[2] Peter C Hayes,[2] Julie Parkes[1]

BMJ 2017;359:j5024

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Three cups of coffee a day 'may have health benefits'

By Philippa Roxby
Health reporter, BBC News

23 November 2017 | Health

The New York Times

For Coffee Drinkers, the Buzz May Be in Your Genes

ANDREW SCRIVANI FOR THE NEW YORK TIMES

By ANAHAD O'CONNOR
JULY 12, 2016

Like most of my work, this article would not have been possible without coffee.

Journal of Nutrigenetics and Nutrigenomics

J Nutrigenet Nutrigenomics 2016;9:106–115
DOI: 10.1159/000446801
Published online: July 29, 2016

1661–6499/16/0094–0106$39.50/0
www.karger.com/jnn

ISNN Consensus Article

Moving towards Specific Nutrigenetic Recommendation Algorithms: Caffeine, Genetic Variation and Cardiovascular Risk

Raffaele De Caterina[a] Ahmed El-Sohemy[b]

[a]Institute of Cardiology, 'G. d'Annunzio' University, Chieti, Italy; [b]Department of Nutritional Sciences, University of Toronto, Toronto, Ont., Canada

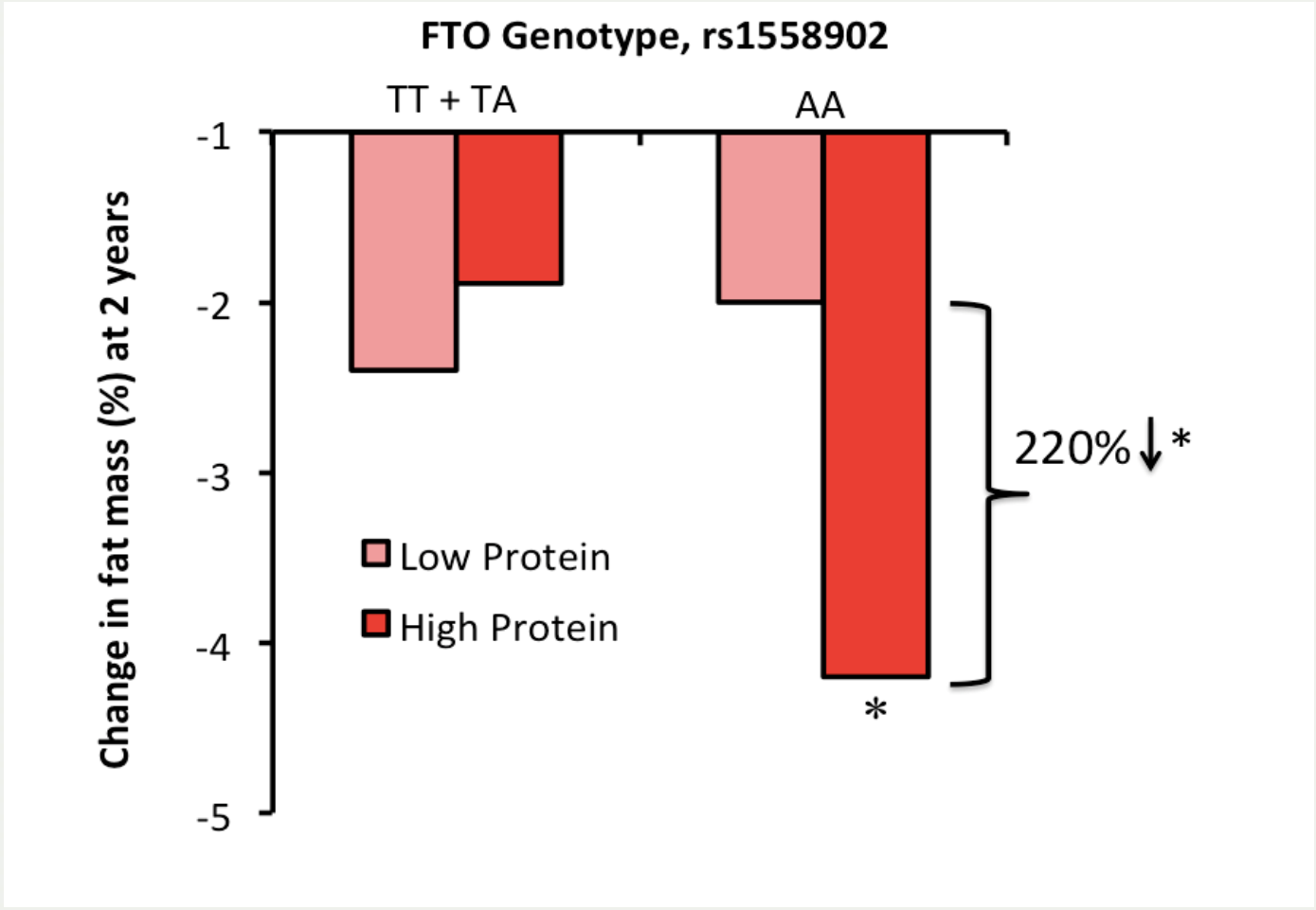
11.27.17 | STARTUP REPORT

DNA-Based Diet Advice Is Big Business With Little Scientific Support

Tech companies are selling expensive diets based on genetic and microbiome sequencing. But scientists say there are no shortcuts to healthy weight loss.

Sadly, we shouldn't hold our breath. A 2015 meta-analysis that examined the available research on this category of startups found that "solid scientific evidence is currently lacking." The science behind these startups is fundamentally flawed, says Aaron E. Carroll, a pediatrician, professor of pediatrics at Indiana University School of Medicine, and author of *The Bad Food Bible*. There's no evidence that some people respond better to high-fat diets while others are more receptive to diets packed with protein or complex carbs. "It doesn't exist," he says. Even if it did, "there's no evidence we could detect it" through DNA sequencing. Metabolic illnesses and disorders such as celiac disease or lactose intolerance aside, humans' genes are very similar. We evolved to be able to eat the same foods.

Loss of fat mass (%) after 2 years of low or high protein diet by FTO genotype



Zhang et al. Diabetes. 2012;61:3005-3011.

Replication

Effects of a High-Protein/Low-Carbohydrate Diet versus a Standard Hypocaloric Diet on Weight and Cardiovascular Risk Factors: Role of a Genetic Variation in the rs9939609 *FTO* Gene Variant

Daniel Antonio de Luis Rocío Aller Olatz Izaola David Primo
Silvia Urdiales Enrique Romero

J Nutrigenet Nutrigenomics 2015;8:128–136

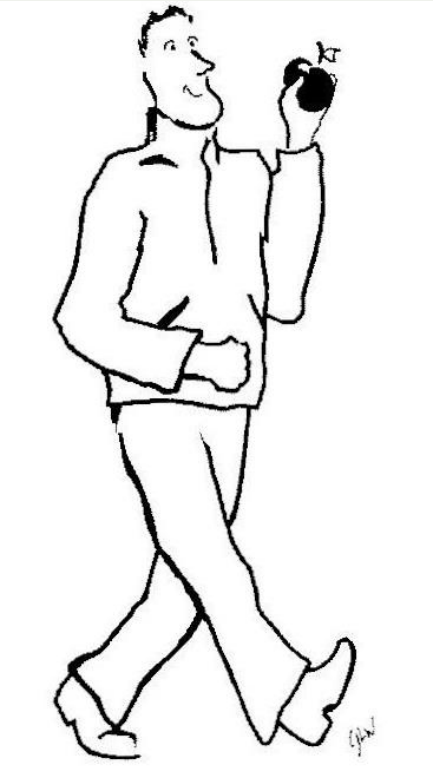
Personalized Dietary Advice

vs

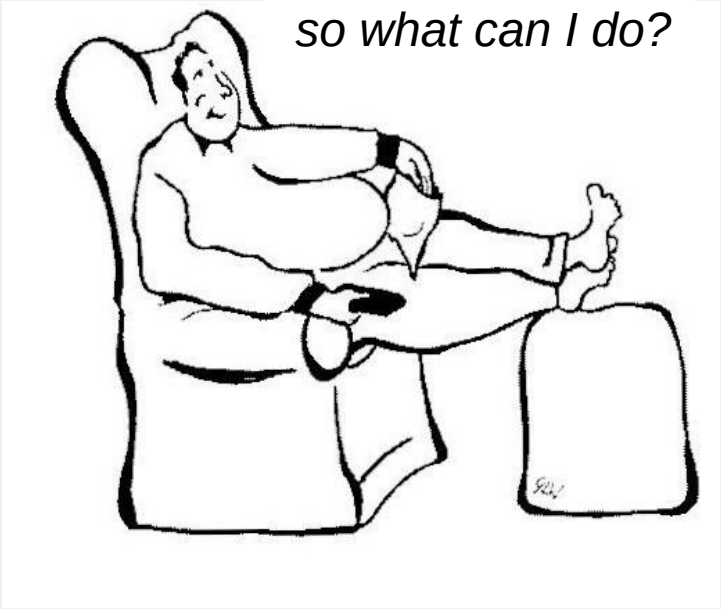
Public Health Recommendations

Does genetic information influence behavior?

I have the gene,
so I eat healthily.



I have the gene,
so what can I do?



Does genetic information influence behavior?

Genes Nutr (2012) 7:559–566
DOI 10.1007/s12263-012-0290-x

RESEARCH PAPER

A randomized trial of genetic information for personalized nutrition

Daiva E. Nielsen · Ahmed El-Sohemy

- DNA-based dietary advice resulted in:
  - greater understanding of recommendations
  - greater interest in learning more
  - greater motivation to change eating habits

Does genetic information influence behavior?

OPEN ACCESS Freely available online

PLOS ONE

Disclosure of Genetic Information and Change in Dietary Intake: A Randomized Controlled Trial

Daiva E. Nielsen, Ahmed El-Sohemy*

Department of Nutritional Sciences, University of Toronto, 150 College St, Toronto, ON, M5S 3E2, Canada

- Greater compliance after 1 year.

Replication: behavior change

An Intervention Study of Individual, apoE Genotype-Based Dietary and Physical-Activity Advice: Impact on Health Behavior

Hanna-Leena Hietaranta-Luoma[a] Raija Tahvonen[b] Terhi Iso-Touru[b]
Hannu Puolijoki[c] Anu Hopia[a]

J Nutrigenet Nutrigenomics 2014;7:161–174

Replication: behavior change

Effect of an Internet-based, personalized nutrition randomized trial on dietary changes associated with the Mediterranean diet: the Food4Me Study[1,2]

Katherine M Livingstone,[3,13] Carlos Celis-Morales,[3,13] Santiago Navas-Carretero,[4,5] Rodrigo San-Cristobal,[5] Anna L Macready,[6] Rosalind Fallaize,[6] Hannah Forster,[7] Clara Woolhead,[7] Clare B O'Donovan,[7] Cyril FM Marsaux,[8] Silvia Kolossa,[9] Lydia Tsirigoti,[10] Christina P Lambrinou,[10] George Moschonis,[10] Magdalena Godlewska,[11] Agnieszka Surwiłło,[11] Christian A Drevon,[12] Yannis Manios,[10] Iwona Traczyk,[11] Eileen R Gibney,[7] Lorraine Brennan,[7] Marianne C Walsh,[7] Julie A Lovegrove,[6] Wim H Saris,[8] Hannelore Daniel,[9] Mike Gibney,[7] J Alfredo Martinez,[5] and John C Mathers[3] on behalf of the Food4Me Study*

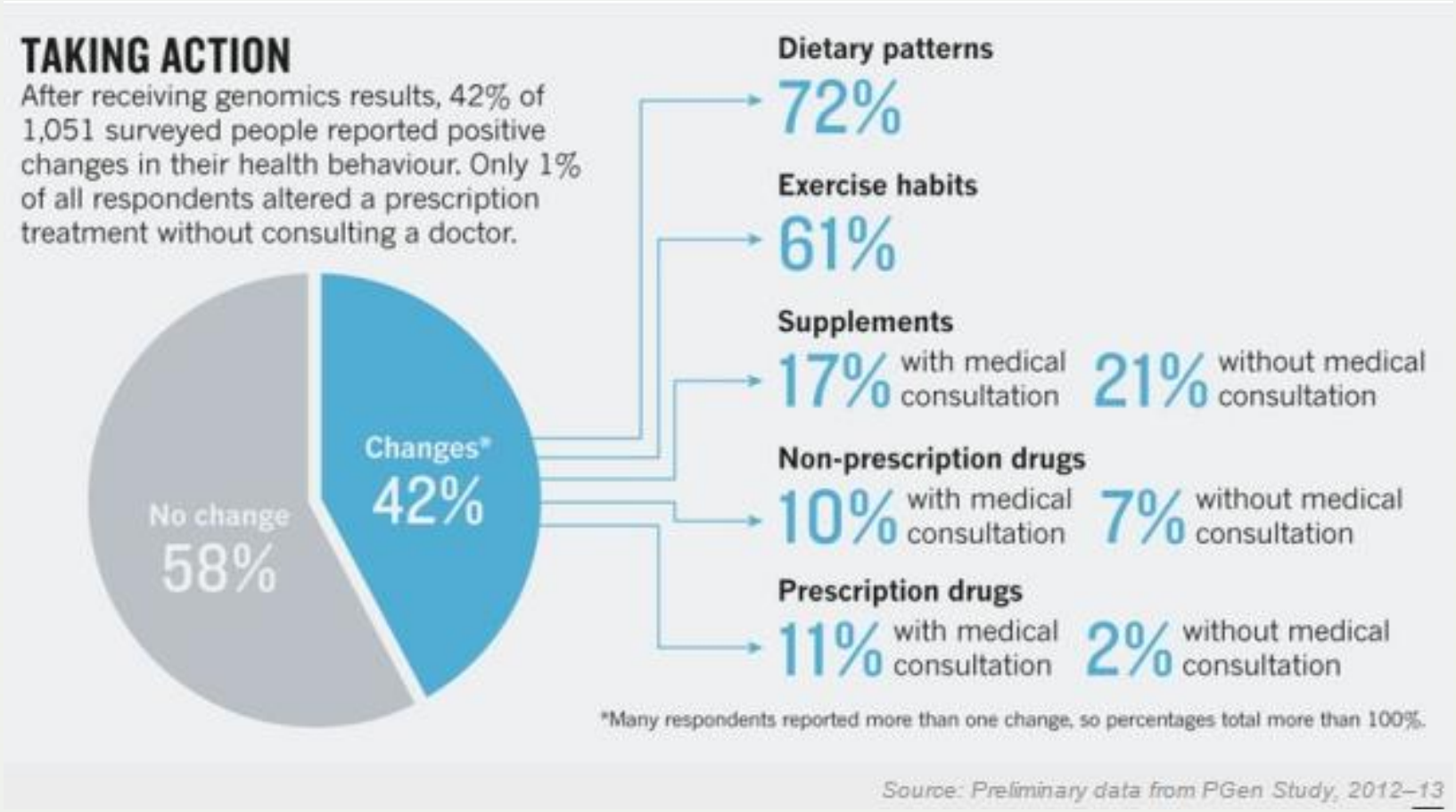
Am J Clin Nutr 2016;104:288–97.

Can genetic-based advice help you lose weight? Findings from the Food4Me European randomized controlled trial[1–3]

*Carlos Celis-Morales,[4,5,16,18] Cyril FM Marsaux,[6,16,18] Katherine M Livingstone,[4,16,18] Santiago Navas-Carretero,[7] Rodrigo San-Cristobal,[7] Rosalind Fallaize,[8] Anna L Macready,[8] Clare O'Donovan,[9] Clara Woolhead,[9] Hannah Forster,[9] Silvia Kolossa,[10] Hannelore Daniel,[10] George Moschonis,[11] Christina Mavrogianni,[11] Yannis Manios,[11] Agnieszka Surwillo,[12] Iwona Traczyk,[12] Christian A Drevon,[13] Keith Grimaldi,[14] Jildau Bouwman,[15] Mike J Gibney,[9] Marianne C Walsh,[9] Eileen R Gibney,[9] Lorraine Brennan,[9] Julie A Lovegrove,[8] J Alfredo Martinez,[7] Wim HM Saris,[6,17,18] and John C Mathers[4,17,18]**

Am J Clin Nutr 2017;105:1204–13.

Replication: behavior change



Green and Farahany (2014) 505, 286–287, *Nature*

Replication: behavior change

Nielsen *et al. BMC Medical Genomics* (2017) 10:24
DOI 10.1186/s12920-017-0258-1

BMC Medical Genomics

RESEARCH ARTICLE Open Access

Diet and exercise changes following direct-to-consumer personal genomic testing

Daiva Elena Nielsen[1,2†], Deanna Alexis Carere[3†], Catharine Wang[4], J. Scott Roberts[5], Robert C. Green[1,2,6,7*], for the PGen Study Group

What do the skeptics say?

FROM THE ACADEMY

Position Paper

Position of the Academy of Nutrition and Dietetics: Nutritional Genomics

J Acad Nutr Diet. 2014;114:299-312.

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.

What the skeptics say…which is false

- Single SNPs are useless.
- People won't change their behaviors.
- It's the microbiome.

Blekhman *et al. Genome Biology* (2015) 16:191
DOI 10.1186/s13059-015-0759-1

Genome Biology

RESEARCH Open Access

Host genetic variation impacts microbiome composition across human body sites

Ran Blekhman[1,2*], Julia K. Goodrich[3,4], Katherine Huang[5], Qi Sun[6], Robert Bukowski[6], Jordana T. Bell[7], Timothy D. Spector[7], Alon Keinan[8], Ruth E. Ley[3,4], Dirk Gevers[5,9] and Andrew G. Clark[3]

Cell Host & Microbe
Resource

Genetic Determinants of the Gut Microbiome in UK Twins

Julia K. Goodrich,[1] Emily R. Davenport,[1] Michelle Beaumont,[2] Matthew A. Jackson,[2] Rob Knight,[3] Carole Ober,[4] Tim D. Spector,[2] Jordana T. Bell,[2] Andrew G. Clark,[1] and Ruth E. Ley[1,5,*]
[1]Department of Molecular Biology and Genetics, Cornell University, Ithaca, NY 14850, USA
[2]Department of Twin Research & Genetic Epidemiology, King's College London, London SE1 7EH, UK
[3]Departments of Pediatrics and Computer Science and Engineering, University of California San Diego, La Jolla, CA 92093, USA
[4]Department of Human Genetics, University of Chicago, Chicago, IL 60637, USA
[5]Department of Microbiome Science, Max Planck Institute for Developmental Biology, 72076 Tübingen, Germany
*Correspondence: rel222@cornell.edu
http://dx.doi.org/10.1016/j.chom.2016.04.017

Cell Host & Microbe *19*, 731–743, May 11, 2016

nature genetics

Association of host genome with intestinal microbial composition in a large healthy cohort

Williams Turpin[1,2], Osvaldo Espin-Garcia[3,4], Wei Xu[4], Mark S Silverberg[1–3], David Kevans[1,2], Michelle I Smith[1,3], David S Guttman[5,6], Anne Griffiths[7], Remo Panaccione[8], Anthony Otley[9], Lizhen Xu[4,10], Konstantin Shestopaloff[4], Gabriel Moreno-Hagelsieb[11], GEM Project Research Consortium[12], Andrew D Paterson[4,10,13] & Kenneth Croitoru[1–3]

published online 3 October 2016;

What the skeptics say…which is false

- Single SNPs are useless.
- People won't change their behaviors.
- It's the microbiome.
- We need to integrate all of the 'omics' technologies.
- Biomarkers are more important.
- We need more evidence. From RCTs.
- Results from genetic tests are too complex.
- Family history is more informative.
- Just follow recommendations for healthy eating.

Where are we today?

- We need to eat……today.
- We currently give dietary advice for healthy eating.
- Current recommendations are based on (old) science.
- How much more evidence do we need?

Is DNA-based Dietary Advice Ready for Prime Time? **Yes**

- Scientific evidence is robust (for some markers)
- Independent of ethnic background
- Improved compliance (evidence from RCT)
- Information is actionable and "personalized"
- Increasing consumer awareness and demand
- Focus on wellness/prevention, not disease treatment

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Special Issue

Nutrigenomics

Guest Editors:

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a.el.sohemy@utoronto.ca

Prof. José M. Ordovás
Director Nutrition and Genomics, Professor Nutrition and Genetics, JM-USDA-HNRCA at Tufts University, USA

Jose.Ordovas@tufts.edu

Deadline for manuscript submissions:
31 October 2017

Message from the Guest Editors

Dear Colleagues,

The integration of various 'omics' technologies into studies linking nutrition to human health and performance has greatly enhanced our understanding of the effects of specific nutrients, food bioactives and dietary patterns. These discoveries have helped us understand individual nutritional requirements, identify the presence of food preferences and intolerances, and establish specific dietary patterns that improve health and performance. This Special Issue of the *Journal of Personalized Medicine* aims to highlight the current state of the science and showcase some of the latest findings in the field of nutritional genomics. Studies include those that explore gene-diet interactions using basic science, clinical and population-based approaches. The scientific advances in the field of nutrigenomics and nutrigenetics will continue to pave the path towards personalized nutrition for optimal health and wellness.

Prof. Ahmed El-Sohemy
Prof. José M. Ordovás
Guest Editors