Workshop

- Factors influencing food intake?
- How decrease food choice related morbidity/mortality
  - Modifiable behavioral traits?
    - Strength /weakness
  - Limits to success of interventions?
- Describe current research
- ID research gaps
- Prioritize research needs
- Cross-agency RFP/RFA document goal
Distillate

“Learning is more important for liking than taste…”

• Maternal influence on child behavior in food choice
  – Education and food choice
    • Unknown salt intake daily
  – Long term policy opportunity stealth lower NaCl intake via labeling campaign?
  – Target childhood obesity? Via nutrition policy?
Distillate

• Biomarkers of food choice changes
  – Dose-response & mechanism?
  – Phenotyping for food choice behaviors?
  – Genotyping (sensory receptors? predictors?)
  – Behavioral vs pharmacologic intervention
    • Addiction/disciplinary x-talk data sets (eg GWAS, target effectors)
    • New drugs to modulate dietary selection?
  – What is the nutritional importance of genetic variations? Value of GWAS studies & attributable risk? SNP importance?
Distillate

- Genetic modifiers of dietary choice
  - Examples
    - Adenosine A2A receptor, GLUT2, dopamine D2 receptor, TAS1R2 SNPS
  - Transgenic / knock-out animal models

- Gene-physiologic pathway dissection
  - Gene-dose effects & (inference v/ human SNP studies)
  - GWAS vs candidate gene approaches
  - Need = increased use of health endpoints in consideration of genotype-diet studies
Distillate

• Epigenome
  – Repertoire of imprinted genes in humans is not known
  – More susceptible to environmental influences vs genetic mutation based mechanisms
  – Fetal origins of adult disease susceptibility in mouse model (public health policies target maternal nutrition leverage?)
  – Food as drug
  – Responses due to imprinting dysregulation will be difficult to extrapolate between species (fund human studies instead?)
Distillate

Mechanism & Obesity

- Fructose utilization in fatty acid flux into tissue lipids contribution to obesity
- Denovo synthesis vs external sources
- Leptin & insulin resistance animal models
- SCD1 conditional knockouts
  - Tissues (eg liver) specific KO
  - High carbohydrate or fat diets & weight gain studies
- Carbohydrate induced lipogenesis
- Why/how gene expression modulated by diet?
- Oleic acid effect on gene methylation?
Distillate

“Taste is tops.”

Summary of Need

• Phenotypes or genotypes that are markers for dietary intake and/or differential risk of chronic conditions (susceptibility biomarker)
  – chemosensory-related genotypes
  – chemosensory phenotypes
  – preference phenotypes
• Consistent measures of phenotyping for multi-center clinical studies
• Measures that have utility, validity, and feasibility for epidemiological studies.
• Intervention studies that consider variation in taste and oral sensation

  • “Flavor drives behavior.
  • Learning is more important for liking than taste…”
Workshop

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“OMICs” AND DIETARY BEHAVIORS

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The genetics of eating behaviors and dietary choices

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Louis Perusse

Summary and conclusion

• Strong evidence of familial aggregation for total energy, macronutrient intakes, food choices and eating behaviors.
  – Stronger correlations between mothers and their children

• Several aspects of eating appears to be influenced by genetic factors
  – Heritability estimates are very heterogenous across studies and tend to be higher when derived from twin studies compared to family studies
  – Sex-differences: generally higher estimates for women

• Environmental factors are more important than genetic factors
  – Shared familial environment more important for children than adults

• Although specific genes have been associated with dietary intake and eating behaviors, relatively little is known about the genes influencing these traits.
  – Eating is a complex behavior, difficult to assess and under the influence of several systems/pathways.
Louis Perusse

- Genetic foundations of eating related behaviors
- Cultural vs genetic traditions
- Family vs twin studies, foster children
- Familial resemblance nutrient intake in Framingham children’s study
- Mother’s influence predominant on children food intake choices total energy and fat
- Macronutrient intake (Quebec studies)
- Adopted children/offspring influences
- Family influence greater than genetic for some nutrients energy intake, but fat intake more 19% genetic influence
- Mother to daughter/mother child strongest influences?
- Heredity affects aspects of eating
  - energy intake & macronut. Twin studies:
  - eating patterns (factor analysis health vs high fat high salt, sugar)
Needs

• Better phenotyping tools for eating behaviors
• Biomarkers of eating behavior
• Influence of education?
• Food taste and smell factors (genetic) leading to food preference
From Zheng et al., Physiology 23:75-83, 2008
Research needs identified

- Understanding salt taste reception and salt taste development throughout the lifespan.
  - Mechanisms of salt taste reception
  - Importance of childhood exposure
- Develop innovative methods to reduce sodium in foods while maintaining palatability, physical properties and safety.
- Enhance current understanding of factors that impact consumer awareness and behavior relative to sodium reduction.
- Monitoring sodium intake and salt taste preference.
  - How can consumers know how much they are consuming?
  - Has the reduction in salt in the food supply reduced preference?
Beauchamp

- Excess food intake and flavor
- Washington Post Magazine cover photo
- Flavor drives behavior
- Smells like….?
  - “Learning is more important for liking than taste”
  - Effects of experience
- Taste
  - Innate response but learning involved
  - 5 receptor classes
  - SALT no longer GRAS (if >50yrs?)
    - Novel compound salt-substitutes?
    - Enhancers?
  - Complex salt-taste mechanisms
  - Behavior changes?
    - Diminish preference for salty via long term small changes?
- Drug/food additives vs behavioral changes re salt intake via policy?
- TASTE throughout the body (eg taste cells in gut)?
  - Effect of artificial sweeteners on these? Pituitary gland etc?
The man who survived anthrax
Dave Barry on spring break

America's Growing Families
Can anything stop the obesity epidemic? By Peter Perl
Gene Polymorphisms and dietary preferences

Ahmed El-Sohemy

Department of Nutritional Sciences
University of Toronto
Ahmed El-Sohemy

- Nutrigenomics
- Diet-gene-food preference interactions
- GWAS vs Gene candidate studies
- Genotype-phenotype
  - Caffeine & smoking
    - cyp1A2 & adenosine A2A receptor
  - Glucose OGTT
    - GLUT2 & Thr110Ile SNP, diabetes T-2 assn.
  - Transgenic / knock-out animal models
    - Gene-physiologic pathway dissection
Epigenetics, Imprinting and Human Health

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Origins
Artist: Collin Murphy
Randy Jirtle

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Future Objectives

- Identify human imprinted genes and their epigenetically-controlled regulatory elements - The Imprintome.
- Determine the role of imprinting in human diseases and neurological disorders.

Artist: James Jirtle

http://www.geneimprint.com
Gene Polymorphisms and Carbohydrate Diets

James M. Ntambi Ph.D.
Mechanism & Obesity

- Fructose utilization in fatty acid flux into tissue lipids contribution to obesity
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Genetic Variations, “Taste” and Dietary Behaviors

Valerie B. Duffy

The Omics of Eating Behaviors:

December 9, 2010

Genetics

Environment

Oral Sensory Function

Food/Beverage Sensation

Food/Beverage Preference (intake)

Diet-related Health Outcomes
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