Nutrigenomics

Kimberly Kreitinger

What is Nutrigenomics?

- Study of how nutrients affect the expression of genes
- Can be used to prevent diseases
- Nutrigenetics (subset of Nutrigenomics)
  - Determines how an individual's genetic information is affected by diet

History

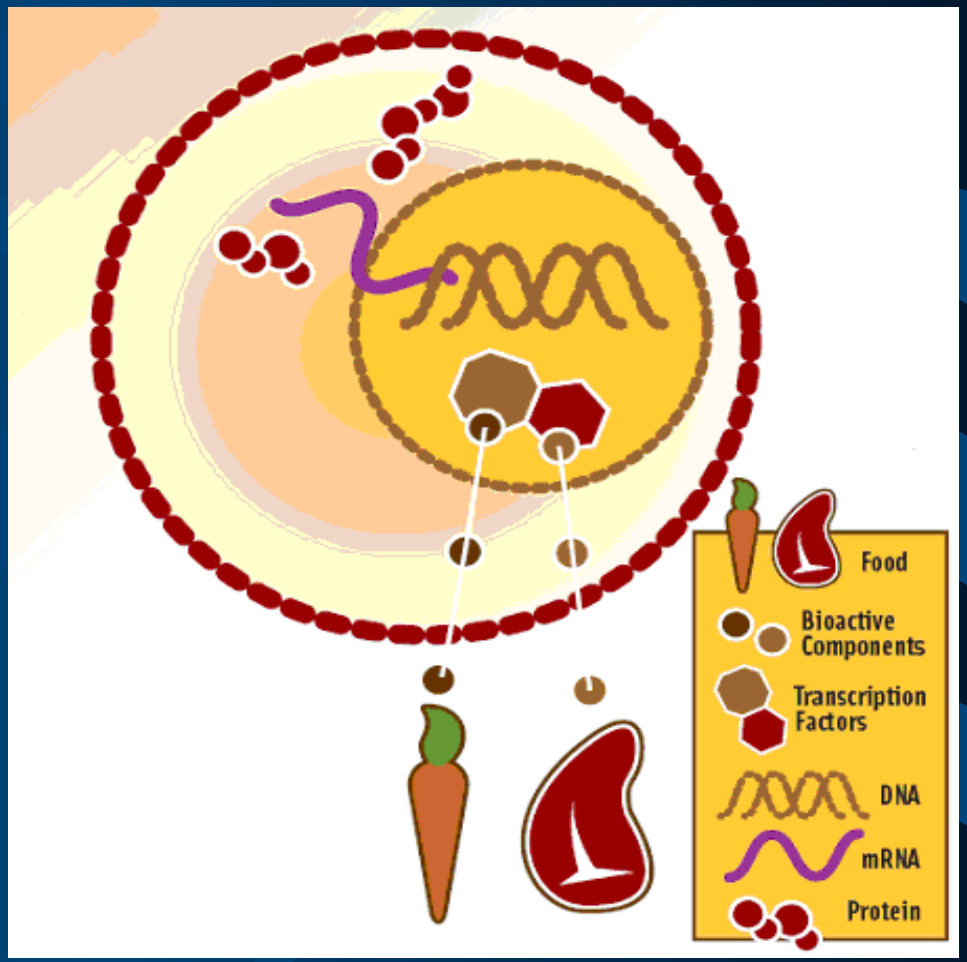
- Nutrient research shifted from epidemiology to genetics in past decade
  - Completion of Human Genome Project
  - Realization that there are genetic predispositions to diseases linked to diet
    - Cardiovascular disease
    - Cancers
    - Diabetes Type II

Future Potential

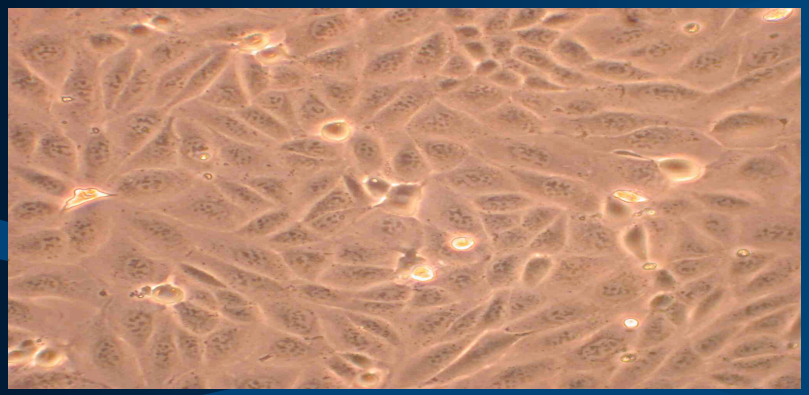
- Form dietary-intervention strategies for individuals in order to prevent diseases
- Change the business models for supplement and food industries
- Validate claims for food products

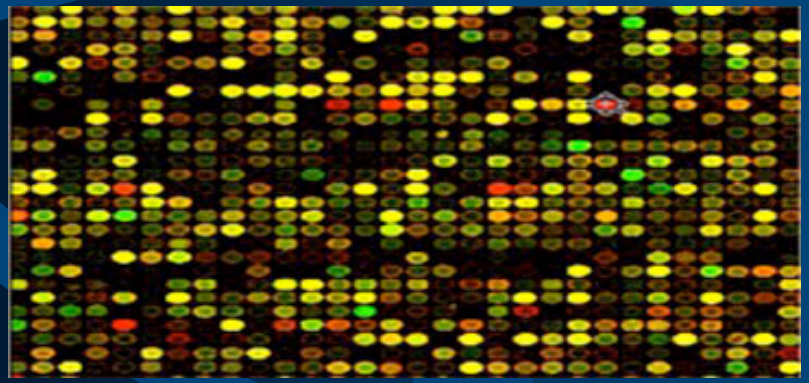
How Do Nutrients Affect Genes?

- Nutrients act as ligands and bind to transcription factors, resulting in the repression or activation of various genes



Tools





- Cell cultures
- DNA microarrays
  - Targets specific genes affected by certain nutrients
- Same tools as genomic tools in terms of research

Caffeinated Coffee

- Habitual Caffeine Consumption
  - Based on genetic variant that affects adenosine receptor

- Increased Risk of Heart Disease
  - Carriers of a gene associated with slow caffeine metabolism

- Decreased Risk of Heart Disease
  - Carriers of a gene associated with fast caffeine metabolism
  - One to three cups of coffee a day

Folic Acid

- Involved in methylation of DNA
  - Undermethylation of DNA, associated with growth of cancer cells, detected in humans with diets deficient in folic acid
- Regulates gene that forms methylenetetra-hydrofolate reductase (MTHFR)
  - CC/CT individuals: normal
  - TT individuals: increased risk of vascular disease and premature cognitive decline
    - Normal with higher intake of folic acid

Polyunsaturated Fatty Acid

- Examples: omega-3 fatty acids (fish), omega-6 fatty acids (vegetable oils)
- Regulates Apolipoprotein A-I gene, which is associated with the production of high-density lipoproteins (HDL)
  - HDL is associated with a decrease risk in coronary heart disease
  - Women:
    - AA/AG: Polyunsaturated fatty acids increase HDL, thus decreasing risk of coronary heart disease
    - GG: Polyunsaturated fatty acids decrease HDL, thus increasing risk of coronary heart disease

Theaflavins

- Found in black tea
- Represses genes associated with inflammation
  - Example: regulates gene that codes for COX-2, an enzyme associated with pain and inflammation

Problems

- Food is highly variable
- Effects of food are not immediate
- Diseases are usually affected by many genes
- Functions of most genes have yet to be determined
- Tissue or organ responsible for affect of nutrient not always known
- Funding for research

Businesses

- WellGen
  - Inflammation
    - WG0401 Patented Enriched Extract from Black Tea
  - Current Project: Obesity
- Salugen
  - Use individual genetic profiles to come up with nutritional regiment
  - Products:
    - HAVEOS- substance abuse and narcotic tolerance
    - GenoTrim- excess cravings contributing to weight problems
    - SpaGen- skin and mental well-being
- Others: Sciona, Suracell, GeneSNP, Gensona, GeneWize

Ethical Issues

- Lack of genomic education on the part of the consumer
- Direct-to-Consumer tests have questionable efficiencies

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