

# Lecture 1: Genomics and Evidence-Based Medicine

## Course: Public Nutrition and Wellness Education

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# Objectives

1. To be able to define Nutritiongenomics.
2. To understand how Nutritiongenomics will shape the future of nutrition and wellness interventions.
3. To be able to list the 5 Tenets of Nutrition Genomics.
4. To be able to clearly define evidence based medicine and the significance of this when interpreting new research.
5. To state the steps involved in evidence based medicine.

# Outline

- Trends in Wellness
- Genomics
  - Nutrition Genomics
- Wellness and Genomics
  - Evidence Based Medicine
- Supplements

# Trends in Wellness



# Headlines!

- Each day we are bombarded with nutrition headlines
  - Vitamin E – now causes heart disease?
  - Trans fats Banned in NYC !
  - Milk will improve your waistline!
- Which headlines are true?
- These are just examples of how it's difficult to decipher what news is really newsworthy

# Trans Fat:

## Have you heard the headlines?

- NYC bans trans fats!
- What is your opinion on the government regulating what we can't eat?
- <http://www.newswise.com/articles/view/526173/?sc=dwtp>
- What do you think the government will ban next?
- How do feel about corporations giving cash back, incentives or other benefits to “healthier employees”, those who don't smoke, have normal cholesterol, or participate in health screenings?



# New in Wellness

- Each year more newspaper, magazines, on line news, articles and books focus on the relation between diet and health
- We are seeing a rise in television programs that discuss topics of disease and prevention/treatment as you flip through the cable channels
- The most significant influence in public awareness and access to health information is the Internet

# News About Trans Fat

## ➤ **Nutrition Facts Labels are growing!**

- Last January 1 (2006), food manufacturers were required by law to print the levels of trans fats on the label of any food containing more than 0.5 grams of trans fat per serving. This requirement is causing many food companies to reformulate their ingredients in order to reduce or eliminate trans fats.

## ➤ **Why are trans-fats bad?**

- Experts agree that trans-fats are the most harmful type of fat in the body, with effects even slightly worse than highly-saturated animal fats. Man made trans fats have been shown to increase inflammation in the body, which causes damage to the arteries and increases the risk of heart disease and other illnesses. They not only raise LDL cholesterol levels in the body (“bad” cholesterol), but they also lower HDL cholesterol (“good” cholesterol).

# Trans Fat Defined

- Trans fats were first introduced in the food supply over 100 years ago with the discovery of a new technology, hydrogenation
- These new trans fats kept food shelf-stable much longer than previously used animal fats
- Trans fats come from fully and partially hydrogenated vegetable oils to make them solid or semi solid, such as those in shortening and solid stick margarine. These fats are used extensively in commercially baked and fried foods including:
  - Pastries, doughnuts, cookies, crackers, pie crust, frosting, candy bars, chips and sometimes even pretzels and toddler's products
  - Trans fats also appear naturally in small amounts in dairy and meat, but this natural form of trans fats does not cause the harmful effects associated with artificially produced trans fats

# Trans Fat

## ➤ How much is OK to eat?

- Limit the trans fat in your diet as much as possible
- Less is better. It is recommended that no more than 10% of your total calories should come from trans and saturated fat combined

## ➤ So, if you eat 2000 calories per day

- No more than 22 grams saturated/trans fat

## ➤ 1800 calories per day

- No more than 20 grams saturated/trans fat

## ➤ 1500 calories per day

- No more than 17 grams saturated/trans fat

\* I rec'd for my clients to get no more than 2 grams of transfats a day. Avoid buying foods w/ transfats by reading Food Ingredient lists and labels!



# Wellness Today

- The Internet provides a wealth of information regarding the etiology, prevention, and treatment of various diseases that can help you become an active partner in your health
  - US Department of Agriculture (USDA; [www.nal.usda.gov](http://www.nal.usda.gov))
  - American Heart Association ([www.americanheart.org](http://www.americanheart.org))
  - American Cancer Society ([www.cancer.org](http://www.cancer.org)).
  - Other information-based businesses such as [www.WebMD.com](http://www.WebMD.com))
  - Internet search engines exist for reading medical abstracts (e.g. [www.nlm.nih.gov/medlineplus](http://www.nlm.nih.gov/medlineplus), [www.pubmd.com](http://www.pubmd.com), <http://www.ajcn.org/> )

# New in Wellness

- The practice of medicine, including health promotion and disease prevention, is on the verge of being revolutionized
- The new field of genomics (study of genes) will connect the medical and scientific community
- We will see a shift from evidence-based medicine (*later defined*) to genomic medicine

# Emerging in Wellness Nutrition

- *More nutraceutical* compounds will be entering the market by way of recombinant-genetic techniques
  - Nutraceuticals: a food (or part of a food) that provides medical or health benefits, including the prevention and/or treatment of a disease
- These techniques resulting in new products are being evaluated in many areas of the marketplace and new regulatory concerns are arising

# Nutraceutical Examples

- An example is the production of eicosapentaenoic acid (EPA) by bacteria. *EPA's benefits will be discussed later in this course*
- EPA is a fatty acid which is produced by some algae and bacteria (for those of you who has seen the Coronado Bridge in San Diego, one company grows this in vats under the Bridge)
- EPA derived from salmon are produced by algae and are later incorporated in the fatty fish like salmon that consume the micro-algae through brine shrimp or other sources

# Nutraceuticals

- EPA can now be produced by non-EPA producing bacteria using these new genetic techniques
- The ability to transfer the production of nutraceutical molecules into organisms that allows for economically feasible production may lead to better health but also requires new policy on regulatory and safety concerns

# Genomics



# Genomics

- In 2001, the complete sequencing of the human genome signified the beginning of the postgenomic era
- New approaches and technologies are causing a shift in biomedical research that can lead to optimal health and nutrition
- A growing understanding of the complex interactions amongst genotype, diet, lifestyle, and environment has induced a change in clinical medical practice as well as medical nutrition therapy

# Genomics

- Scientists increasingly believe that most, if not all, diseases have a genetic component
- Genetic testing is becoming an integral part of health care with great potential for future test development and use, to help prevent and treat disease
- However, be careful of nutrition companies that evaluate DNA samples to identify your risk factors
- Although some are legitimate, it is mostly unnecessary
  - There are evidence-based methods that can determine your risk factors for disease and prescribe diet modification for much less money
  - In some cases I have rec'd genetic evaluation but this is still evaluated w/a complete diet and lifestyle questionnaire

# Modern Medicine

- Disease is viewed as a failure of any one or more of the structures and functions of human physiology
- Physicians systematically diagnose this breakdown and apply the appropriate treatment
  - for example, surgery is used to remove a diseased part or natural or synthetic pharmacological agents are administered to correct a dysfunction
- This approach lead to a highly specialized practice of medicine, one that employed infection control, uses technology and specialized drugs to focus on organ-system disorders and diseases

# Emerging Genomics

- In the postgenomic era, the projected current aim is to apply gene therapy to health promotion and disease prevention
- Nutrition-genomics will tailor a specific diet based on one's individual genetic response to specific diets
  - By utilizing one's genetic response to foods, disease prevention and treatment will lead to a new paradigm in diet therapy!

# Genomics and Nutrition Therapy

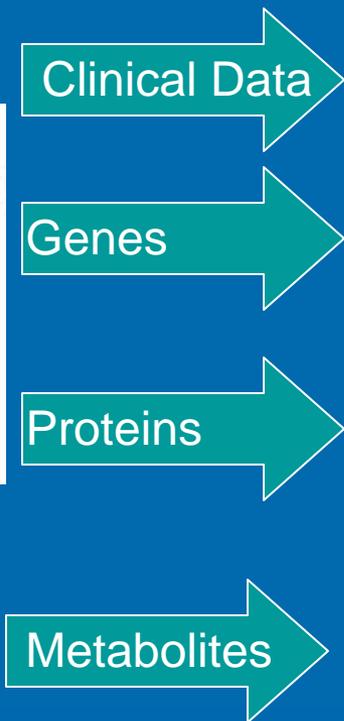
- The Human Genome Project will have nutrition therapy implications on:
  - Cardiovascular disease
  - Hypertension
  - Obesity
  - Diabetes
  - Cancer
  - Osteoporosis

# Genomics and the Development of Disease

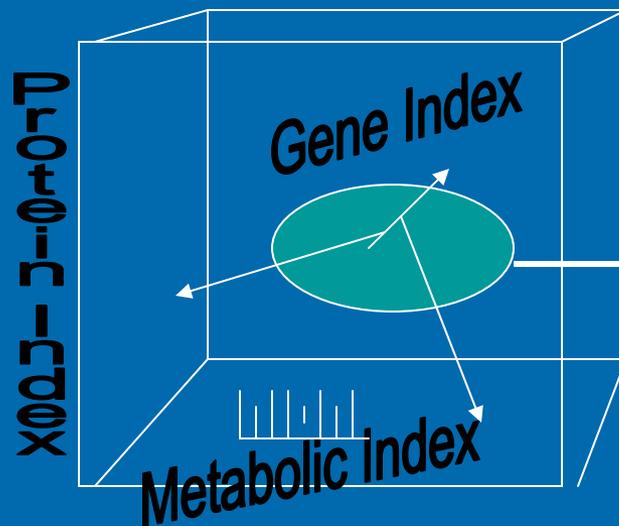
- Genetics plays a major role in the development of the diseases but now we are discovering that it's more than just your genes and your diet –it's how they interact
- Many diseases are considered preventable with current diet and lifestyle interventions effects could be minimized by:
  - A healthier diet
  - Physical activity and fitness
  - Weight management
  - A healthier environment
  - Safe Supplementation under advisement of a physician or dietitian
  - Consuming foods that have been formulated or fortified to include health-promoting factors

# Emerging Genomics & Nutrition

- The sequencing of the human genome will change evidence and population-based protocols to a new unique and personalized therapy
  - We may receive a grocery store list based on genotype and not just risk factors
- With recent discoveries in human genetics and with a deeper understanding of the hundreds of compounds found in food, more complex interactions between your diet and your DNA are beginning to be uncovered
- Eventually this will give consumers more personalized advice about what to eat and drink to prevent disease and degenerative changes
- "We are trying to put more science behind the nutrition," says Jose Ordovas, a geneticist at the Friedman School of Nutrition at Tufts. "We want to finally understand why nutrients do what they do and to whom--why a low-fat diet may not work for some but works for others."



Clinical & Family History,  
Functional Imaging and  
Laboratory Testing



GENOMIC MEDICINE IN CLINICAL NUTRITION: Futuristic genomic medicine in **Clinical Nutrition**, where genomics, proteomics, and metabolomics are coupled with clinical information for screening and diagnosis purposes and are integrated through bioinformatics to determine health and disease prevention strategies. Adapted from Nestec LTD, Vevey and S. Karger AG, Basel .

2011-2012-2013-2014-2015-2016-2017-2018-2019-2020-2021-2022-2023-2024-2025-2026-2027-2028-2029-2030-2031-2032-2033-2034-2035-2036-2037-2038-2039-2040-2041-2042-2043-2044-2045-2046-2047-2048-2049-2050-2051-2052-2053-2054-2055-2056-2057-2058-2059-2060-2061-2062-2063-2064-2065-2066-2067-2068-2069-2070-2071-2072-2073-2074-2075-2076-2077-2078-2079-2080-2081-2082-2083-2084-2085-2086-2087-2088-2089-2090-2091-2092-2093-2094-2095-2096-2097-2098-2099-2100

# Nutritional Genomics, Nutrigenetics, and Nutrigenomics

- The Center of Excellence for Nutritional Genomics at the University of California, Davis sets for the following five tenets of nutritional genomics to serve as a conceptual basis for understanding the focus and promise of this emerging field of nutrition genomics
- Center of Excellence for Nutritional Genomics at the University of California at Davis Nutrigenomics. Available at: <http://nutrigenomics.ucdavis.edu>. Accessed June 29, 2004

# 5 Tenets of Nutritional Genomics

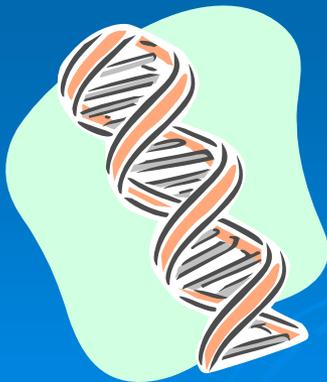
1. Under certain circumstances and in some individuals, diet can be a serious risk factor for a number of diseases
2. Common dietary chemicals can act on the human genome, either directly or indirectly, to alter gene expression or structure
3. The degree to which diet influences the balance between healthy and disease states may depend on a person's genetic makeup

# 5 Tenets of Nutritional Genomics

4. Some diet-modulated genes (and their normal, common variants) are likely to play a role in the onset, incidence, progression, and/or severity of chronic diseases
5. Dietary intervention based on knowledge of nutritional requirement, nutritional status, and genotype (i.e., personalized nutrition) can be used to prevent, mitigate, or cure chronic disease

# Diet and Genes

- It isn't just what you eat that can kill you, and it isn't just your DNA that can save you
  - It's how they INTERACT



# Nutrition Genomics

- “Interactions among genes, gene variants and nutrition are dynamic and not yet predictable. But with the completion of human genome, we have the capacity to understand cellular networks,” says Patrick J. Stover, PhD, director of the division of Nutritional Science at Cornell University in Ithaca, New York
- With an increased understanding of the roughly 25,000 genes in the body comes the ability to change these cellular networks for the health of individuals
- Genetic testing is becoming an integral part of health care with great potential for future test development and use

# Example: Folic Acid

- Studies show up to 20 percent of Americans have a genetic variation that prevents them from completely metabolizing folate (found in grains and beans)
- People could benefit from having more dietary folate (folic acid supplements), which is protective against cancer as well as heart disease
- Folic acid is already added to cereals to prevent neural tube birth defects such as spina bifida

# Example: Broccoli



Boosts genes that protect against heart disease

- **Gene Name:** GST
- **Function of Gene:** Produces the body's master antioxidants glutathione
- **Long term effect:** additional glutathione helps keep arteries healthy
- *Future: we will see the development of food derived treatments and functionally enhanced foods to improve health and prevent disease specific to one's genetic make up*

# Nutrigenomics Is The Future But, What Can You Do Now?

- **If you have a family history of high cholesterol**, limit saturated fat and dietary cholesterol
  - Try eating at least 3 plant meals for either lunch or dinner per week. Increase fish in your diet
  - Consider the Mediterranean diet discussed in week 3
- **If you have a family history of high blood pressure**, try the Dash Diet (Dietary Approaches to Stop Hypertension).
- Use less processed and canned foods for they are high in sodium. Eat fruits and vegetable as snacks in place of snack items, such as baked chips, pretzels, or cheese.  
<http://www.nhlbi.nih.gov/health/public/heart/hbp/dash/>
  - Also consider a Mediterranean type diet

# Nutrigenomics: What Can You Do Now

- **If you have a family history of overweight or obesity,** take steps to maintain a healthy weight or lose weight (see Weight Management Course)
  - Additional resources at:  
[http://www.nhlbi.nih.gov/guidelines/obesity/e\\_txtbk/txgd/43.htm](http://www.nhlbi.nih.gov/guidelines/obesity/e_txtbk/txgd/43.htm)
- **Get Moving!** Find ways to incorporate physical activity in to your daily life, find something you like that's realistic and stick with it. Consider getting a buddy to help keep you both motivated!
- **If you have a family history of type 2 diabetes or pre-diabetes,** take steps to prevent insulin resistance. Get screened and know the current guidelines for diagnosis. Avoid obesity and limit refined carbohydrates and beverages and foods with added sugar. Don't drink soda!

# In the Future

- Get your blood checked and get your diet customized
  - Yes there are services that do this now but not to the extent we'll see it in the future. (Many are overpriced and under-deliver, often come w/expensive supplementation plans or a heavy price tag; some aren't legitimate)
- Provide the basis for personalized dietary recommendations based on the individual's genetic make up
- Provide tools to detect genetic predisposition and to prevent common disorders decades before their manifestation



# Nutrition Genomics

- It may be at least a decade or two away... but the research is beginning and is quite interesting
- There are some “fad” or “non researched” based diets that claim to do this now, but they lack evidence based science
- The best advice now is to follow dietary prescriptions specific to one’s known disease risk factors

# Genetic Testing Scams

- Some genetic tests are sold directly to the consumer via the Internet or retail stores, and purport to use genetic information to deliver personalized nutrition and lifestyle guidance
- These tests require consumers to self-collect a sample of genetic material, usually from a cheek swab (rough DNA cells), and then forward the sample to a laboratory for analysis
- Companies that market this type of test claim to provide consumers with the information needed to tailor their diet and exercise programs to address their genetically determined health risks –again some are legitimate some are not
- GAO (US Government Accountability Office) was asked to investigate the "legitimacy" of these claims



# Genetic Testing Scams: GAO Case Study

- Specifically, GAO purchased tests from four Web sites and created "fictitious consumers" by submitting for analysis 12 DNA samples from a female and 2 samples from an unrelated male, and describing this DNA as coming from adults of various ages, weights, and lifestyle descriptions
- GAO also consulted with experts in genetics and nutrition

# Genetic Testing Scams: GAO Case Study

- The results from all the tests GAO purchased misled consumers by making predictions that are medically unproven and so ambiguous that they do not provide meaningful information to consumers
- Although there are numerous disclaimers indicating that the tests are not intended to diagnose disease, all 14 results predict that the fictitious consumers are at risk for developing a range of conditions

# Genetic Testing Scams: GAO Case Study

- Although some types of diseases, such as cystic fibrosis, can be definitively diagnosed by looking at certain genes, the experts at GAO stated that the medical predictions in the test results can not be medically proven at this time
- Even if the predictions could be medically proven, the way the results are presented aren't helpful
- For example, many people "may" be "at increased risk" for developing heart disease, so such an ambiguous statement could relate to any human that submitted DNA
- Results from the tests that GAO purchased from Web sites 1 and 4 further mislead the consumer by recommending costly dietary supplements
- The results from the tests from Web site 1 suggested "personalized" supplements costing approximately \$1,200 per year

# Genetic Testing Scams: GAO Case Study

- However, after examining the list of ingredients, GAO found that they were substantially the same as typical vitamins and antioxidants that can be found in any grocery store for about \$35 per year
- Results from the tests from Web site 4 suggested expensive products that claimed to repair damaged DNA
- There is no "pill" currently available that has been proven to repair damaged DNA, in some circumstances, taking supplements such as those recommended may be harmful, results from the tests that GAO purchased from Web sites 1, 2, and 3 do not provide recommendations based on a unique genetic profile as promised, but instead provide a number of common sense health recommendations you can get for free through many government websites

# Nutrition Genomics Summary

- The preliminary results involving gene-diet interactions for cardiovascular diseases and cancer are promising, but not conclusive
- Preliminary evidence strongly suggests that the concept should work and that we will be able to harness the information contained in our genomes
  - Achieve successful aging using behavioral changes
  - Nutrition will be the cornerstone of this endeavor





# Nutrition Genomics Summary

- These new technologies can be integrated with databases of genomic sequences and inter-individual genetic variability, enabling the process of gene expression to be studied for many thousands of different genes in parallel
- Such techniques can facilitate the definition of optimal nutrition at the level of populations, particular groups, and individuals. This in turn should promote the development of food derived treatments and functionally enhanced foods to improve health!

# Further Reading

- It is currently being evaluated if Registered Dietitians will need to add genomics as a requirement to fulfilling their degree
- For a few resources regarding nutrition implications of genomics and also RD's future role refer to: JADA
  - Nutritional genomics in practice: Where do we begin? Debusk RM, Fogarty CP, Ordovas JM, Kornman KS Journal of the American Dietetic Association April 2005 (Vol. 105, Issue 4, Pages 589-598)
  - Nutrigenomics: From Molecular Nutrition to Prevention of Disease Afman L, Müller M Journal of the American Dietetic Association April 2006 (Vol. 106, Issue 4, Pages 569-576)

# Further Reading

- Incorporating human genetics into dietetics curricula remains a challenge Vickery CE, Cotugna N Journal of the American Dietetic Association April 2005 (Vol. 105, Issue 4, Pages 583-588)
- Nutrigenomics: the Rubicon of molecular nutrition Gillies PJ Journal of the American Dietetic Association December 2003 (Vol. 103, Issue 12 (Supplement), Pages 50-55)
- Metabolomics in Practice: Emerging Knowledge to Guide Future Dietetic Advice toward Individualized Health German JB, Watkins SM, Fay LB Journal of the American Dietetic Association September 2005 (Vol. 105, Issue 9, Pages 1425-1432)
- Continuing Education Needs of Registered Dietitians Regarding Nutrigenomics Josen R, Earthman C, Marquart L, Reicks M Journal of the American Dietetic Association August 2006 (Vol. 106, Issue 8, Pages 1242-1245)

# Wellness and Genomics



# Wellness & Genomics

## Needed Changes

- Snyderman and Williams proposed a model of prospective medicine and personalized health care that focuses on the creation of an advanced information system that integrates multiple streams of patient information to generate both a personalized risk profile and a set of recommendations of measures to reduce that risk
- The risk assessment tool uses data from conventional clinical assessments and biomarker analysis derived from genomics, proteomics, and appropriate advanced functional imaging
- These new paradigms of the health care delivery system have a major impact on medical education and practice

It is essential that medical education and nutrition curriculum be adjusted and improved so that health care professionals and future physicians are prepared to deliver health care focusing on the maintenance of wellness, as well as treatment of disease in the postgenomic era.

Many Universities are now including curriculum on nutritiongenomics



# Evidence-Based Medicine Defined

- Evidence-based medicine entails the systematic approach of formulating a question, developing literature search strategies, and evaluating and applying evidence to establish clinical practice guidelines
- Genomics is the study of all of the nucleotide sequences, including structural genes, regulatory sequences, and noncoding DNA segments, in the chromosomes of an organism

# Evidence-Based Medicine

- The current approach to clinical decision making in medicine is based on the diagnosis of disease based on signs and symptoms. This also considers the structure and the function of the organ system, established etiology, and recommended appropriate therapy
- The physician is a patient's main source of care, which is mostly reactive and relies, to a certain extent, on the experience, knowledge, and expertise of the physician and the description of symptoms that the patient provides



# Evidence-Based Medicine

- Physicians may refer their patients to specialized medical professionals for further care and treatment
- With the development of evidence-based medicine, clinicians are able to consult the abundance of resources of current and past evidence and then draw the best conclusions to specific problems and make the best clinical decision



# Evidence-Based Medicine

- Registered Dietitians also use this systematic approach of formulating a question, developing literature search strategies, and evaluating and applying the evidence when providing medical nutrition therapy
- Health care professionals utilize evidence based medicine to avoid fad, antidotal, made-up, non-researched approaches
- Often the “fad” or non-researched approaches are promoted as “cure alls” the “final say” or “scientific breakthroughs” that have actually caused harm in the long term or have had life threatening negative effects

# Evidence-Based Medicine

- Various databases and resources are now available, including
  - The Agency for Health Care Research and Quality: Evidence-Based Practice
  - The Cochrane Library
  - The National Guidelines Clearinghouse
  - Various practice guidelines developed by academic medical societies
- Medical Search Programs: [www.pubmed.com](http://www.pubmed.com)
- For many free research articles on nutrition check out: <http://jn.nutrition.org>
- [www.mayoclinic.com](http://www.mayoclinic.com)

# Steps Involved in Evidence-Based Medicine

The evidence-based review process consists of a stepwise general procedure that includes

- 1) the development of an appropriate, focused, and clear measurable question from observations made during the patient encounter
- 2) completion of literature searches
- 3) determination of the quality of designs
- 4) assessment of the comparability of source populations of cases and control studies
- 5) recognition of whether controls for potential confounding factors and measurement errors were included
- 6) the search for evidence of any difference in effect by age, gender, or subsets of disease

# Evidence-Based Medicine

- The reviewer must also consider any evidence of a dose–response effect or heterogeneity effect between studies, the integration of evidence by pooled analysis or meta-analysis and the evaluation of results and expert panel recommendations
- The prevalence of evidence-based medicine has reached the realms of clinical decision making and medical school curricula, and insurance companies even draw on its invaluable resources to formulate their guidelines for client reimbursement
- Many clinicians consider evidence-based medicine a criterion standard, whereas others view it as a recipe for medicine

J. Nutr. 134:3513S-3516S, December 2004

Metabolic Issues of Clinical Nutrition :227-242 Karger AG Basel, Switzerland. Nestle Nutrition Workshop Series Clinical and Performance Program, Vol. 9, 2004.

# How Does This Apply to Wellness?

- Institutions and legitimate medical/research and scientific organizations utilize evidence-based medicine to determine recommendations and clinical standards
- For example, the Food and Nutrition Board of the Institute of Medicine has used the applications of evidence-based reviews by expert panels to establish the Recommended Dietary Allowance of particular nutrients and Dietary Reference Intakes
  - When you're eating your cereal and reading the box and you look at the % daily value of certain vitamins and minerals, understand that evidence based medicine was utilized to determine the amounts

# How Does This Apply to Wellness?

- When you're evaluating news in nutrition, pick up a yoga, fitness or health magazine, and a product or food is promoted as preventing or curing a disease, as a health care professional you can evaluate if it has gone through the testing of evidence based medicine
- As a healthcare professional it is important to discuss how these foods or products are evaluated with your client
- As a person it's important to understand the processes behind the science when evaluating if a product or process is right for you

# Shift to Wellness

- We are seeing a slow shift in health care which is focusing on the maintenance of wellness, as well as treatment of disease; however many preventative services remain uncovered by insurance companies
- Various disciplines have already begun to integrate such curricular changes in recognition of and accordance with the postgenomic age
- Many institutions such as the Kaiser Health Systems in California, offer prevention and wellness classes to their employees free of charge.
- (However, as a Previous Clinical Nutrition Manager and Wellness Implementer it is a challenge to change the mindset from current treatment of illness to prevention of illness). Plus healthcare providers aren't rewarded or encouraged by policy to take proactive/preventive care in many instances

# Supplements



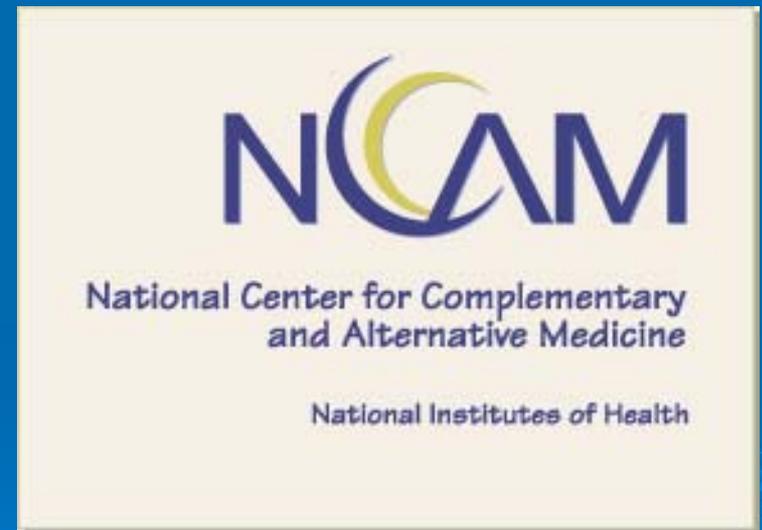
# Complementary and Alternative Medicine (CAM)

## ➤ Complementary

- Practices used in addition to conventional medicine

## ➤ Alternative

- Practices used in place of conventional medicine



# Complementary and Alternative Medicine (CAM)

## ➤ Nutrition in CAM

- Vegetarian diets
- Macrobiotic diet
- Food restrictions and prescriptions
- Need for scientific evaluation

# Testing Process

- It is not uncommon for a successfully introduced pharmaceutical to incur \$800 million in research costs and over a decade of work and trials on 1000's of individuals to get a drug to market
  - Having worked on phase 3 drug trials as a Registered Dietitian providing patient counseling, the time, money and energy that goes into deeming a drug safe was surprising and still there are no fail safe methods
  - Animal studies that assess drug's toxicity in acute, chronic, and multigenerational situations are studied
  - The absorption, metabolism, and excretion these drug compounds are also studied in animal models, along with studies on their potential efficacy

# Testing Process

- With nutraceuticals little or no testing is done with few or no requirements for safety
- Often studies done by supplemental companies are poorly controlled and designed

# Testing Process

- For Supplements or Functional Foods: A number of ingredients have been classified as Generally Regarded as Safe (GRAS). This is based upon documentation submitted to the FDA (Food & Drug Administration), on the presence and safety of the ingredients in the human diet
- When viewing the differences in testing pharmaceuticals and nutraceuticals one can see a marked difference in safety and efficacy
- Just because something is natural doesn't mean it's safe – just think of tobacco or opium
- Unfortunately, there isn't as much money to be gained, from an isolated food such as blueberries compared to a drug at. Therefore there is less funding available
- However, with increased funding from the food industry, more research is occurring

# Dietary Supplements in the Marketplace

## ➤ Regulations

- Dietary Supplement Health and Education Act
- FTC (Federal Trade Commission): advertising
- FDA: labeling, content
  - No pre-market approval required
  - Supplement Facts panel
  - Claims

# Regulating Supplements

- The FDA does NOT regulate supplements similar to medication
- Under the *Dietary Supplement Health and Education Act (DSHEA)*, dietary supplements are regulated by a specific regulatory category & enforced by the Center for Food Safety and Applied Nutrition (CFSAN) under the US Food and Drug Administration (FDA)
- ***DSHEA places the responsibility of proving a supplement to be unsafe or contaminated or of false or misleading labeling on the FDA rather than the manufacturer***

# Is My Supplement Safe?

- According to DSHEA, dietary supplements must have the identity and strength on the label, and meet appropriate specifications for quality (including tablet or capsule disintegration), purity and composition
- Manufacturers may voluntarily pay to have their product undergo testing for certification passing set standards for quality, purity, disintegration, and dissolution
- **Often there are drug/supplement/herbal interactions just as there are drug –food interactions**

# Certification Programs

- Look for any of these on your vitamin bottle, it doesn't indicate safety, but indicates it contains what is listed on the bottle:
- Council for Responsible Nutrition  
[www.CRNUSA.org](http://www.CRNUSA.org) (excellent)
- The Public Health and Safety Company  
[www.nsf.org](http://www.nsf.org)
- The United States Pharmacopeia  
[www.usp.org](http://www.usp.org)
- [www.consumerlab.com](http://www.consumerlab.com)
- American Herbal Product Association  
[www.AHPA.org](http://www.AHPA.org)



# Case Study Example: Echinacea

- For example Echinacea pallida is often promoted to help prevent against colds
- Gilroy designed a study to evaluate Echinacea's effectiveness and then ordered dried samples from three suppliers to conduct the study
  - Samples from each supplier were sent out for analysis of chemicals that were known to distinguish the species and that might even have therapeutic activity
- The data that came back put her study on hold. There was not a single batch containing pure E. pallida
- What little there was consisted solely of E. purpurea
- The other batches, acquired directly from coneflower growers, did contain E. pallida- but also contaminating plants, including E angustifolia

# Case Study Example: Echinacea

- Gilroy then turned to 59 commercial Echinacea products from local stores. Her team's analyses, reported in the March 2004 Archives of Internal Medicine, show that none offered consumers what had been promised by its label
  - Six contained no evidence of any Echinacea, and 28 failed to contain the specific species that was listed on the box. Some offered Echinacea in quantities exceeding or, more often, falling below the quantity on the label, sometimes substantially
- The troubling findings suggest that many herbal-product makers aren't maintaining adequate quality control
- For further case studies see:

[www.health.state.ny.us/regulations/task\\_force/docs/dietary\\_supplement\\_safety.pdf](http://www.health.state.ny.us/regulations/task_force/docs/dietary_supplement_safety.pdf)

# DSHEA

- The *Dietary Supplement Health Education Act* (DSHEA) of 1994 further said that certain nutrition support claims could be made for a dietary supplement without the need for it to be regulated as a drug
- This legislation permits the use of dietary supplement “structure/function” claims on foods as well as dietary supplements without prior FDA authorization
- These nutritional support claims cover areas such as:
  - Claims about classical nutritional deficiencies
  - Structure or function effects
  - Mechanisms for structure or function effects
  - General health and well-being

# DSHEA

- The DSHEA requires that manufacturers have evidence to support claims for nutritional support and the manufacturer may be required to include a disclaimer stating that the claim has not been evaluated by the FDA
- Many US companies have received warnings by the FDA about claims made for their products

# Approved Dietary Claims

- If there is evidence that a specific nutrient can help w/a disease process certain health claims on food labels are permissible:
  - Calcium and osteoporosis
  - Sodium and hypertension
  - Saturated fat and cholesterol and heart disease
  - Fat and cancer
  - Folic acid and neural tube defects
    - This means that supplements that contain calcium or folic acid may be able to make use of these established and permitted health claims.

# FDA

- Since supplement companies do not have to go through rigorous testing the FDA has insufficient data legislative authority to require specific safety data from dietary manufacturers or distributors before or after their products are made available to the public
- If they were considered food additives the FDA would have the authority, in addition the biological active components of some of the vitamin's ingredients are similar if not identical to some medications

# FDA

- Public safety of supplements can not be assured
- Healthcare professionals, consumers and manufactures should be using the FedMed Watch adverse reporting system to report adverse events
- I also encourage the use of independent evaluation of supplements like [www.consumerlab.com](http://www.consumerlab.com)
- Other helpful links include:  
<http://ods.od.nih.gov/index.aspx> , and  
<http://www.iom.edu/>

# Reliability

- When recently reading an article in a yoga journal I came across: Are your herbs safe? It advised to purchase supplemental products from reputable retail outlets such as natural food stores
  - As I frequent natural stores for many purchases to fit a healthy lifestyle it needs to be reiterated that being natural doesn't equate to safety
- The article also stated: "by law all ingredients in a dietary supplement must be listed on the label, and if there are no ingredients listed this is a red flag"
- However, time has shown that many supplements which include listed ingredients have been tainted with additional harmful substances that aren't listed on the label or don't contain what is stated
  - In one study, only half of creatine preparations passed the quality tests
  - One brand of S-adenosylmethionine contained only about 30% of the amount claimed

# Resources for Supplement Evaluation

- **American Botanical Council**  
[www.herbalgram.org](http://www.herbalgram.org)
- **ConsumerLab.com** [www.ConsumerLab.com](http://www.ConsumerLab.com)  
(subscription fee)
- **Supplement Watch**  
[www.supplementwatch.com](http://www.supplementwatch.com)
- **FDA's Warnings & Safety Information and Dietary Supplements**  
[www.cfsan.fda.gov/%7Edms/ds-warn.html](http://www.cfsan.fda.gov/%7Edms/ds-warn.html)
- **Quack Watch** [www.quackwatch.com](http://www.quackwatch.com)
- **American Herbal Products Association**  
[www.ahpa.org](http://www.ahpa.org)

# Reliable Sources

- Check out [www.nccam.nih.gov](http://www.nccam.nih.gov) (National Center for Complementary and Alternative Medicine)
- [www.fda.gov](http://www.fda.gov) (the US Food and Drug Administration)
- [www.consumerlab.com](http://www.consumerlab.com) (read summaries of recent tests)
- Talk with your healthcare provider prior to supplementation and check for drug herb interactions.

# To Treat or Prevent Non-Deficiency Diseases

- When making a decision on how to treat or prevent a disease
  - Consider if the expected benefit is acute
  - Consider if the aim is the long-term prevention of chronic diseases such as cancer, heart disease or osteoporosis, diabetes
- Listed below are some examples where the effect of the supplement or functional food is expected to become apparent within days, weeks or months.
  - Evening primrose oil may be taken by women in the belief that it will reduce the symptoms of premenstrual syndrome or reduce the breast tenderness (mastalgia) that many women experience at certain times during their menstrual cycle
  - Fish oils may help lower triglycerides

# Supplements in Wellness

- Fish oil preparations may give symptomatic relief from the pain of arthritis
- Certain fermented foods containing living cultures of bacteria (probiotics) are claimed to reduce the incidence of gut or vaginal infections
- Fish oils and fermented foods: health benefits, current trends and research will be discussed later

# Supplements in Wellness

- Listed below are some examples of supplement or functional food that have long term effects that can't be measured acutely
  - For benefits that can't be measured for decades, research is more challenging as proper study controls are more expensive, difficult and costly
  - However, in a measurement like heart disease, the marker cholesterol may be substituted for outcome measures
    - This will be slightly flawed
    - Keep in mind around half of the people who have heart attacks have normal cholesterol
  - It is suggested that taking calcium supplements or eating foods with added calcium in the teenage years may reduce the risk of osteoporosis fractures in old age
    - Changes in bone density measured after weeks or months may be used as early indications of 'success' (Note Vitamin D, Mg, Vit K, Potassium also have a role in bone health)

# Supplements Possible Benefits

- Margarine and other foods with high levels of certain plant sterols are claimed to lower the blood cholesterol concentration (discussed in Functional Food Course)
  - Although high blood cholesterol concentration is asymptomatic it is associated with high risk of coronary disease
  - So products with plant sterols are promoted and used in the belief that they will, in the long term, reduce the risk of death from coronary heart disease

# Supplements in Wellness

- When used with the aim of long-term disease prevention, relatively large doses of supplements (or functional foods) may be taken over several decades with no immediate apparent benefit or risk for the consumer
- However time will tell if the benefits outweigh the risks
- As the benefits of 'treatment' are expected to take some years to develop, it makes it difficult to test for both effectiveness and safety
  - **It may take years for a potential benefit or harm to occur**

# Do Supplements and Functional Foods Work? Testing Their Effectiveness and Safety

- When dietary deficiency diseases were first being identified, the beneficial effects of a Vitamin or mineral could be validated by testing the effect of a vitamin or foods rich in a specific nutrient on a symptom or disease
- For example, supplementing w/vitamin C alleviates scurvy and iodine cures goiter
  - The more subjective the outcome measure the more likely the 'placebo effect' will occur –
    - If the subject perceives a therapy as beneficial they may feel better as a psychological response

# Supplements in Wellness

- To conduct studies to evaluate the effectiveness of a supplement or functional food many variables have to be considered, subjects have to be matched by gender, lifestyle, age, ethnicity and, diet habits
- If outcome measures are evaluated with very large samples of people for many years in prospective studies or in a retrospective approach they still are not considering one's unique genotype
  - This may be why we see varying results for similar hypothesis
  - For example in one study beta-carotene helps prevent cancer and in other it may cause it

# Supplements in Wellness

- There are studies which measure a supplement or functional food's effect on a disease risk factor.
  - For example, measuring a supplement's effect on lowering cholesterol
  - This may indicate that it will also lower the risk of heart disease -but it's still not cause and effect
  - A supplement can be shown to lower blood pressure which may indicate that it will reduce the risk of a stroke
    - However, it could contribute negatively in other disease risks.
  - A supplement can be shown to improve some measure of antioxidant status which may indicate that it will protect against chronic disease, however, it could also cause it for example in studies where supplementation actually 'fed' cancer cells or protected damage cells in a way that contributes to negative outcomes

# Supplements in Wellness

- If a supplement lowers cholesterol it doesn't mean it will lower heart disease incidence
  - A leap of cause and effect can not be made
- Any claims about benefit are predictions based on the assumption that lowering a risk factor will result in reduced incidence of the disease
- It's also assuming that the supplement or functional food will not have some other detrimental effect that will cancel out or even exceed any benefits
- Consider the beta carotene supplementation in smokers showed to increased the risk of lung cancer
- Consider that some vitamin E supplementation trials at levels higher than 200 IU/day showed increased risk of death
- Many people believe more is better putting them at further risk
  - For example they eat energy bars for the added vitamin and minerals while taking highly potent multi-vitamin and mineral supplements

Thank You!!

