

## Toxins in Our Food- What Can We Do About It?

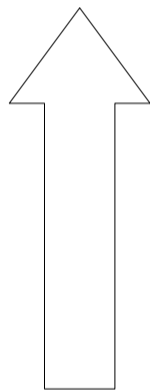
Benjamin Kligler, M.D., M.P.H.  
Associate Professor of Family  
Medicine  
Albert Einstein College of Medicine

## SESSION OBJECTIVES

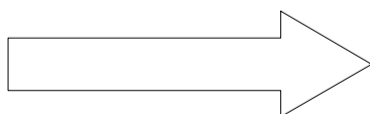
- To identify issues in our food supply that can affect nutritional status
- Identify strategies to improve dietary intake
- Discuss strategies for minimizing exposure to pesticides and environmental toxins

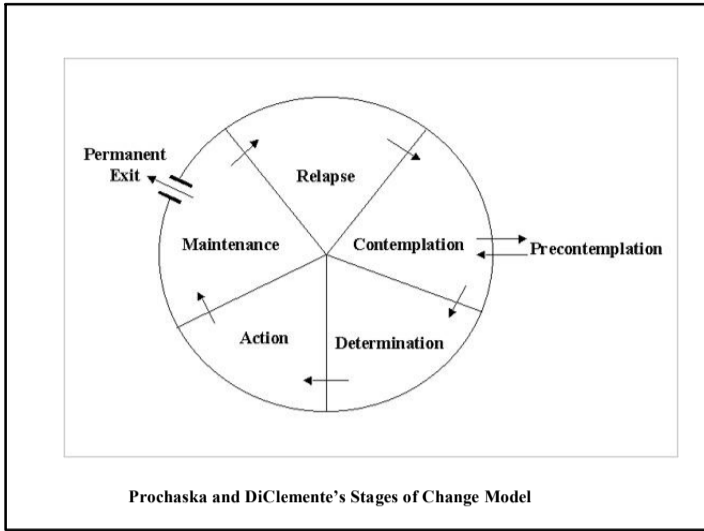
How do people change?

- LIKE THIS?



- OR LIKE THIS?





**PRECAUTIONARY PRINCIPLE**

**No evidence of harm ≠ evidence of no harm**

Or as mom used to say...

**AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE**

**CHEMICAL EXPOSURES**

- 80,000 chemicals in commercial use
- Very few have been tested for health effects
- Increased risk in communities of color, recent immigrants, socially marginalized groups due to proximity to industrial sites, hazardous wastes, pesticides in agricultural communities and diesel fumes in urban areas

**START AT THE BEGINNING: TOXINS IN BREAST MILK?**

- “Contamination of human milk is widespread and is the consequence of decades of inadequately controlled pollution of the environment by toxic chemicals. The finding of toxic chemicals in breast milk raises important issues for pediatric practice, for the practice of public health, and for the environmental health research community.”
- Landrigan PJ, Sonawane B, Mattison D. et al Chemical contaminants in breast milk and their impacts on children's health: an overview *Environmental Health Perspectives*. 110(6):A313-5, 2002

**Flame retardant found in breast milk** USA TODAY 9/22/2003

- A toxic chemical used to make furniture, foam and electronics fire resistant is turning up in high amounts in the breast milk of women in the USA.
- Two studies found that all of the women tested were contaminated with polybrominated diphenyl ethers. Their PBDE levels were the highest in the world: 10 to 20 times higher than those in Europe, where the chemicals are being phased out.
- The Environmental Working Group, a non-profit environmental research organization, tested the milk of 20 women. It found levels ranging from 9.5 to 1,078 parts per billion.

## ROCKET FUEL?

- Researchers found perchlorate, a component of fuel for rockets and missiles in each of 36 breast-milk samples taken from 18 states and in all but one of 47 dairy milk samples from 11 states.
- The average level in breast milk was 10.5 micrograms per litre, while the average in dairy milk was 2.0 micrograms per litre. The NAS reports that a "safe" perchlorate-intake limit should be set at about 4 micrograms per litre for a baby.
- The NAS study concluded there is "insufficient data" to establish a definitive link between perchlorate exposure and neurodevelopmental problems, but animal studies suggest perchlorate can damage the thyroid, which regulates metabolism. The chemical may disrupt metabolism in adults and lead to mental retardation in children.
- DasGupta P, et al. American Chemical Society (2005, February 24). Perchlorate Found In Dairy And Breast Milk Samples From Across The Country

## BUT BREAST IS STILL BEST!!!

- Sweden is monitoring levels of PBDE (flame retardant) in breast milk—has been associated with negative impact on developing brain in animals
- Regulatory controls and monitoring has led to decreased levels of PBDE in breast milk

## WHY THE FOCUS ON CHILDREN AND TOXIN EXPOSURES?

- Increased exposure per body weight
- Pharmacokinetics differ from adults
- Differential susceptibility to harm during critical developmental windows
- Longer life span



"You may not feel any healthier right away, but you'll definitely feel more smug."

## ORGANIC FOODS

- UW researchers compared organophosphorus pesticide metabolite levels in 18 children (age 2-5) with diet of >75% organic vs. 21 children with diet >75% "conventional"
- Median dimethyl metabolite concentration was 6 times higher in the children eating conventional diets
- Curl CL, Fenske RA, Elgethun K. Organophosphorus Pesticide Exposure of Urban and Suburban Preschool Children with Organic and Conventional Diets *Environmental Health Perspectives* Volume 111, Number 3, 2003

## ORGANIC FOODS: 10 fruits and vegetables to buy organic

- |   |   |
|---|---|
| • Peaches--iprodione and methyl parathion | • Grapes--methyl parathion, methomyl          |
| • Apples--methyl parathion, chlorpyrifos  | • Strawberries--captan                        |
| • Pear--methyl parathion, Ops             | • Raspberries--captan, iprodione, carbaryl    |
| • Winter squash--dieldrin, heptachlor     | • Spinach--permethrin, dimethoate, DDT        |
| • Green bean--neurotoxic OPs, endosulfan  | • Potatoes--dieldrin, methamidophos, aldicarb |

Source: Consumers Union 1999

## ORGANIC FOODS: HORMONES AND POPS

- rBGH
- Estrogen residues/endocrine-disrupters
- Antibiotics
- Pesticides/insecticides
- POPS (persistent organic pollutants)
  - Dieldrin
  - PCBs
  - Furans
  - Dioxin

## IS ORGANIC FOOD SAFER?

- No specific evidence from scientific studies to date
- Environmental contaminants like heavy metals not excluded in organic foods
- Organic produce is more “stressed” and thus may produce more phytochemicals...
- Is lower nitrate content in organic produce significant?
- Magkos F, Arvaniti F, Zampelas A Organic Food: Buying More safety or Just Peace of Mind? A Critical review of the Literature. *Critical Reviews in Food Science and Nutrition*. 2006 46:23-56.



“It gets worse: ‘Contains partially hydrogenated oils.’”

### Nutrition Facts

Serving Size 1 cup (200g)  
Servings per container 2

Amount per serving

Calories 220      Calories from Fat 100

% Daily Value\*

Total Fat 12g	18%
Saturated Fat 3g	15%
Trans Fat 2g	
Cholesterol 30 mg	10%
Sodium 235 mg	10%
Total Carbohydrate 16g	5%
Dietary Fiber 5g	20%
Sugars 4g	

Protein 6 g

Vitamin A  
Vitamin C  
Calcium

\* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.

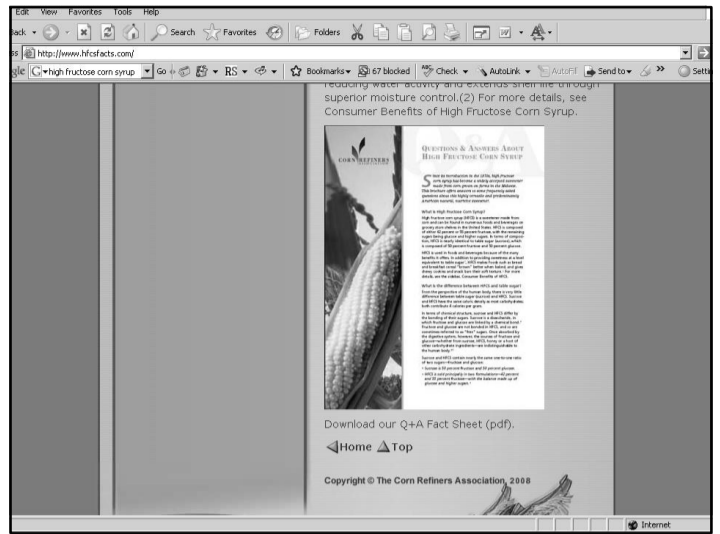
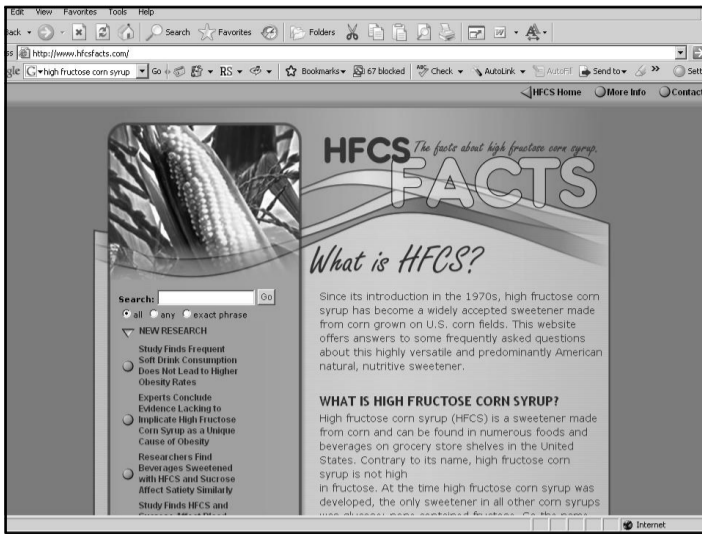
**TRANS FATS  
ARE NOT  
FOODS**

## ARE TRANS FATS REALLY SO BAD???

- Increase heart disease
- Increase LDL
- Decrease HDL
- Increase inflammation
- Mozaffarian D, Katan MB, Ascherio A, Stampfer MJ, Willett WC. Trans fatty acids and cardiovascular disease. *New England Journal of Medicine* 2006 354(15):1601-13

## HIGH FRUCTOSE CORN SYRUP

- Rat studies show elevated cholesterol, cardiac hypertrophy, liver damage
- Chronically elevated insulin levels
- Decreased insulin receptor sensitivity
- Increased risk of metabolic syndrome/ diabetes
- **HFCS IS NOT A FOOD**
- Role of food politics....



## MERCURY

- Blood mercury levels in NYC adult women three times national average
- 18.9% of women 20-49 had levels  $\geq 5.8$  mcg/L
- $\frac{1}{4}$  of NYC residents and nearly  $\frac{1}{2}$  of Asian New Yorkers have blood mercury at or above 5 mcg/L
- Fish consumption most significant source
- 2007 NYC DOHMH Health Advisory #11

## EATING FISH SAFELY

- Exposure to PCBs in utero linked to significantly lower IQ scores and reading comprehension at age 11
- Study of children born to women who ate Lake Michigan fish during pregnancy and lactation
- Although larger concentrations of PCBs were transferred in breastmilk than in utero, there was no impairment in children who were only exposed via lactation—may suggest a unique susceptibility of the developing fetal brain to PCBs
- Joseph L. Jacobson and Sandra W. Jacobson, Intellectual Impairment in Children Exposed to Polychlorinated Biphenyls in Utero. NEJM 1996 Vol. 335 No. 11 783-789.

## EATING FISH SAFELY

- Choose wild-caught instead of farmed for most species
- Avoid large predatory species
- Keep portions modest and vary type of seafood you choose
- Use cooking methods that reduce PCBs/dioxins, such as trimming skin, fat and dark meat, avoiding frying, removing mustard from crabs and tomalley from lobsters
- Choose small fish, low in fat, non-bottom dwellers
- Be aware of state-by-state fish advisories if eating fish you or someone else has caught
- Source: Children's Health Environmental Coalition HealthHouse website [www.chechnet.org/healthHouse](http://www.chechnet.org/healthHouse)

CHEC's Safe Fish Chart				
Frequent Consumption 2 to 3 times per week	Once a Week (with no other fish)	Once a Month or Less (with no other fish)	Avoid Highly Contaminated	Overfished Wild Species
Anchovies Clams (Farmed) Crawfish Fish Sticks Flounder, Atlantic (Summer or Fluke, Winter or Sole) Flounder, Pacific (Starry) Rainbow Trout (Farmed) Shrimp (Farmed) Shrimp (Trap-Caught, i.e., California Spot Prawns, Atlantic Northern Pin Shrimp)	Catfish (Farmed) Cod, Atlantic Cod, Pacific Crab (except Blue from Gulf of Mexico) Crappie Haddock Hake, Atlantic Hake, Pacific Herring Mahi Mahi (Hook-and- Line Caught) Mackerel, Atlantic or Boston Oysters (Farmed, and Not from Gulf Of Mexico) Perch Pollock, Pacific Salmon, Wild Alaskan and Pacific Sardines Sea Bass, Striped (Farmed) Scallops, Bay Scallops, Sea (Farmed) Smelt Sunfish Tilapia (Farmed) Tuna, Canned Chunk Light (Not White)	Bullheads Mackerel, Jack and Spanish Mussels (Farmed) Oysters (Farmed in Gulf of Mexico) Pollock, Atlantic Salmon, Farmed (Includes All Atlantic Salmon)	Bass, Freshwater Bass, Largemouth Bass, Sea Bluefish Carp Catfish, Wild Channel Blue Crab, Gulf Of Mexico Great Lakes Fish Groupers Halibut, Pacific Lobster King Mackerel Orange Roughy Pike Red Snapper Shark Swordfish Tilapia Tuna, Steaks Tuna, Canned White (Albacore) Walleye White Croaker	Caviar (Sturgeon Roe) Cod, Atlantic Flounder, Atlantic Flounder, Pacific Grouper Hake, Atlantic Halibut, Atlantic Lingcod Lobster Monkfish Orange Roughy Pollock, Atlantic Red Snapper Salmon, Wild Atlantic Sea Bass, Chilean (aka Patagonian Toothfish) Shark Sole, Atlantic Sole, Pacific Sturgeon Swordfish Tilapia Tuna, Bluefin

## TOXINS IN OUR WATER

- **NYC: Traces of Sedatives in NYC Water**
- By JEFF DONN – March 2008
- **NEW YORK (AP)** — Locals say this city makes the world's best bagels from the best water, piped in from rustic reservoirs up to 150 miles north. Yet few know of a secret ingredient in their source water: a dash of pharmaceuticals.
- Research studies have turned up minute amounts of more than 15 drugs or their byproducts in several pristine-looking rivers, a reservoir, and aqueducts feeding the country's biggest water system. Though barely measurable, these pharmaceuticals are present in a variety worthy of a medicine cabinet: drugs for aches, infections, seizures and high blood pressure; hormones for menopause; the active ingredient in a popular sedative; and caffeine — all bound for the city that never sleeps.

## HOUSEHOLD EXPOSURES

- long-term study of 254 children in NYC over the first three years of life
- examined household rather than dietary exposure to toxic chemicals
- “children exposed prenatally and in early childhood to the organophosphate chlorpyrifos via household pesticide use may have increased risk of developmental delay.”
- children with the highest blood levels of chlorpyrifos had five times the risk of developmental delay compared to children with the lowest blood levels
- **Rauh VA Garfinkel R, Perera FP, Andrews HF. Impact of prenatal Chlorpyrifos Exposure on Neurodevelopment in the First 3 years of Life Among Inner-City Children. Pediatrics. 2006; 118(6): 1845-1859**

## PARKINSON'S AND PESTICIDES

- **OBJECTIVE:** Chronic, low-dose exposure to pesticides is suspected to increase the risk for Parkinson's disease (PD), but data are inconclusive.
- **Cancer Prevention Study II Nutrition Cohort, a longitudinal investigation of US men and women initiated in 1992 by the American Cancer Society.** Follow-up surveys were conducted in 1997, 1999, and 2001. The 143,325 individuals who returned the 2001 survey and did not have a diagnosis or symptoms of PD at baseline (1992) were included in the analyses.
- **RESULTS:** Exposure to pesticides was reported by 7,864 participants (5.7%), including 1,956 farmers, ranchers, or fishermen. Individuals exposed to pesticides had a 70% higher incidence of PD than those not exposed (adjusted relative risk, 1.7; 95% confidence interval, 1.2-2.3;  $p = 0.002$ ). The relative risk for pesticide exposure was similar in farmers and nonfarmers. **should seek to identify the specific chemicals responsible for this association.**
- **Ascherio A, Chen H, Weisskopf MG, O'Reilly E, McCullough ML, Calle EE, Schwarzschild MA, Thun MJ. Pesticide exposure and risk for Parkinson's disease. Ann Neurol. 2008 Jan;63(1):128.**



## Health risks of BPA: Should we panic?

- Of 115 published animal studies, 81% found significant effects even from low level BPA exposure
  - Early puberty
  - altered immune function
  - Behavioral effects including hyperactivity and impaired learning
  - Decreased testosterone

## CHOOSING SAFE BABY AND SELF-CARE PRODUCTS

- 163 infants, measured urinary phthalate metabolites; 81% had detectable levels—lotions, powders and shampoos significantly correlated with increased urine concentrations of metabolites
- Endocrine disrupters, possible effects on male reproductive function
- Known developmental and reproductive toxicants in animal models
- Levels in breast milk associated with abnormal reproductive hormone levels in infants at three months
- Sathyanarayana S, Karr CJ, Lozano P, et al. Baby Care Products: Possible Sources of Infant Phthalate Exposure. *Pediatrics* 2008 121:260-268

## CHOOSING SAFE HOUSEHOLD PRODUCTS

- Phthalates
- Insect repellants
- pesticides
- Solvents
  - formaldehyde
  - benzene
  - toluene



## NUTRIGENOMICS

- Common dietary chemicals act on the genome to alter gene expression
- In some individuals with genetic susceptibilities, diet and its effect on diet-regulated genes can be an important risk factor for chronic disease
- e.g. effect of dietary fat on nuclear receptors known as PPARs which effect gene transcription

## NUTRIGENOMICS

- Possibility that high doses of certain nutrient substrates in certain genetically susceptible people could reduce the possibility of diseases which result from decreased enzyme function
- e.g. MTHFR (methylenetetrahydrofolate 677C-T) polymorphism, which due to a smaller pool of a given enzyme leads to homocysteine accumulation, which has been linked to heart disease risk...could we prevent this with very high doses of folate to susceptible people?

## NUTRIGENOMICS

- BUT...how do we identify the susceptible people?
- No research yet regarding actual ;patient-centered outcomes
- Difficulties of carrying out large studies when we are talking about individual genetic variations....
- How do we know high dose of vitamins and nutrients over the long term are safe ?

## Nutritional Support Strategies: Antioxidants?

- Will antioxidant supplements enhance function of detoxification systems?
- Are they safe?
- Meta analysis of 68 randomized trials with 232,606 participants
- Beta carotene, Vitamin A, Vitamin E supplementation may increase overall mortality
- Bjelakovic G, Nikolova D, Gluud LL, et al. Mortality in Randomized Trials of Antioxidant Supplements for primary and Secondary prevention. JAMA 2007 297: 842-857.

## THE NATIONAL CHILDREN'S STUDY

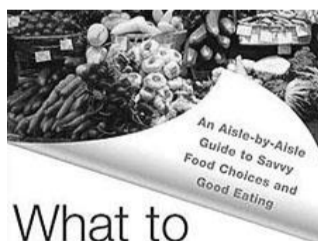
- US Congress directed the National Institute of Child Health and Human Development, through the Children's Health Act of 2000, to conduct the National Children's Study.
- The National Children's Study is hypothesis-driven and will seek information on environmental risks and individual susceptibility factors for asthma, birth defects, dyslexia, attention-deficit/hyperactivity disorder, autism, schizophrenia, and obesity, as well as for adverse birth outcomes.
- To be conducted in a nationally representative, prospective cohort of 100,000 US-born children. Children will be followed from conception to 21 years of age. Environmental exposures (chemical, physical, biological, and psychosocial) will be assessed repeatedly during pregnancy and throughout childhood in children's homes, schools, and communities.
- Landrigan PJ, Trasande L, Thorpe LE, et al, The National Children's Study: a 21-year prospective study of 100,000 American children. Pediatrics. 118(5):2173-86, 2006

## THE NATIONAL CHILDREN'S STUDY

- Chemical assays will be performed by the CDC and banks of biological and environmental samples will be established for future analyses.
- Genetic material will be collected on each mother and child and banked to permit study of gene-environment interactions.
- Recruitment is scheduled to begin in 2007 at 7 Vanguard Sites and will extend to 105 sites across the United States. The National Children's Study will generate multiple satellite studies that explore methodologic issues, etiologic questions, and potential interventions.
- Landrigan PJ, Trasande L, Thorpe LE, et al, The National Children's Study: a 21-year prospective study of 100,000 American children. Pediatrics. 118(5):2173-86, 2006

## Take Home Message...

- Eat food
- Not too much
- Mostly from (local or organic) plants.
- --Michael Pollen, In Defense of Food



What to  
**EAT**  
Marion Nestle

## Mediterranean diet

