

# Reconnecting health care to public and environmental health

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# Environment Drives Chronic Disease

Environmental  
Factors



Chronic  
Disease

Altered Pathways

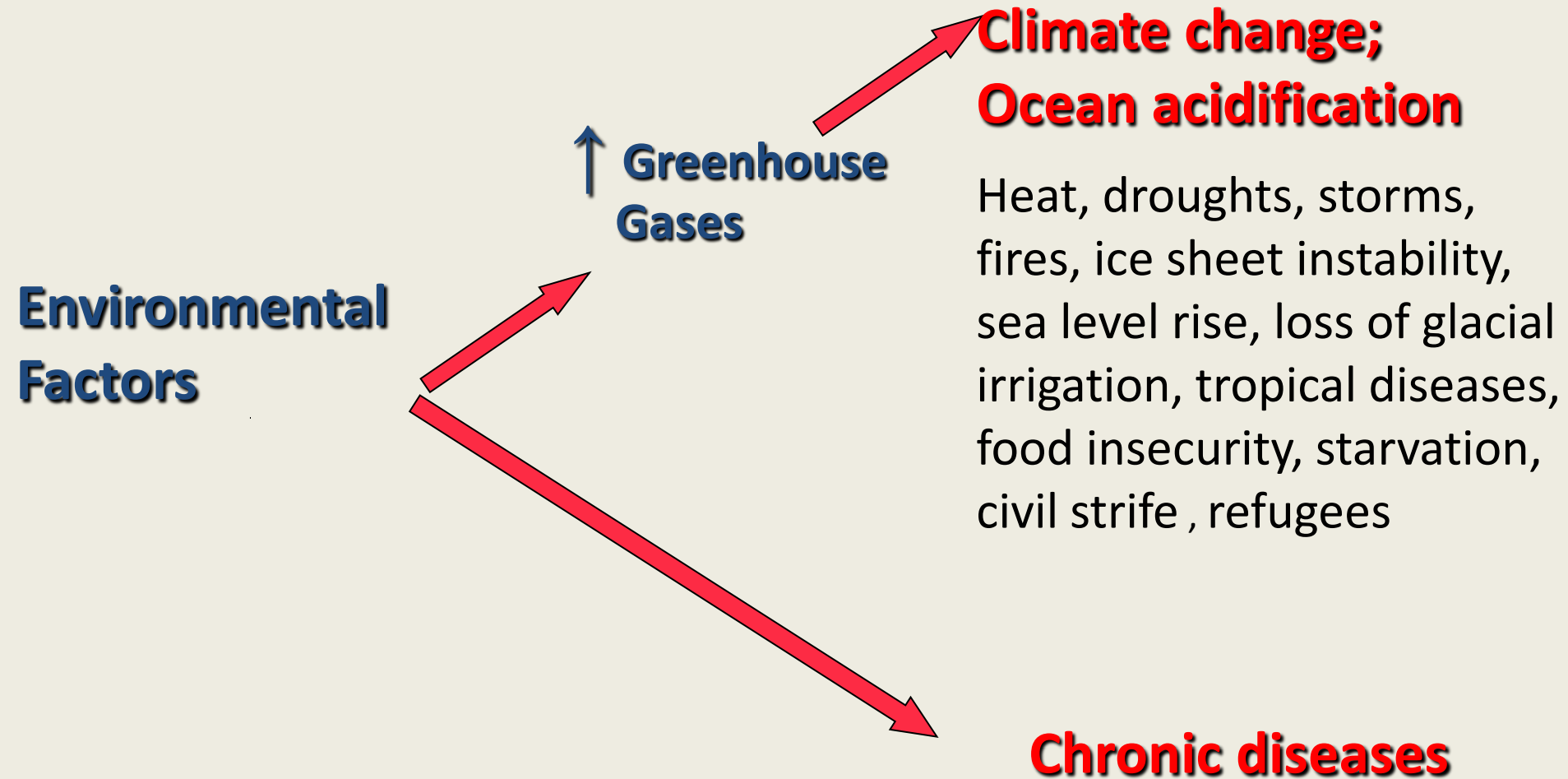
Western Disease Cluster

- **Food system/Diet**
- **Environmental chemicals**
- **Built Environment/Transportation**
- **Social environment**
- -----
- **Natural environment**
- **Green space**

- **Inflammation**
- **Disrupted Insulin Signaling**
- **Oxidative Stress**
- **Endocrine disruption**
- **Gene mutation**
- **Altered gene expression**

- **Diabetes**
- **Obesity**
- **Metabolic syndrome**
- **Cardiovascular disease**
- **Cancer**
- **Cognitive decline, dementia**

# Chronic diseases and climate change, ecosystem disruption



# Common complex diseases

- Diabetes, obesity, cardiovascular disease, many kinds of cancer, cognitive decline, dementia, asthma
- Many contributing, multi-level, causal risk factors
- Complex systems problems
- Design problems requiring design solutions

# Foresight Tackling Obesities: Future Choices Project

- Attempts to capture some of the features of a complex problem: the origins of childhood obesity

[www.bis.gov.uk/assets/foresight/docs/obesity/17.pdf](http://www.bis.gov.uk/assets/foresight/docs/obesity/17.pdf)

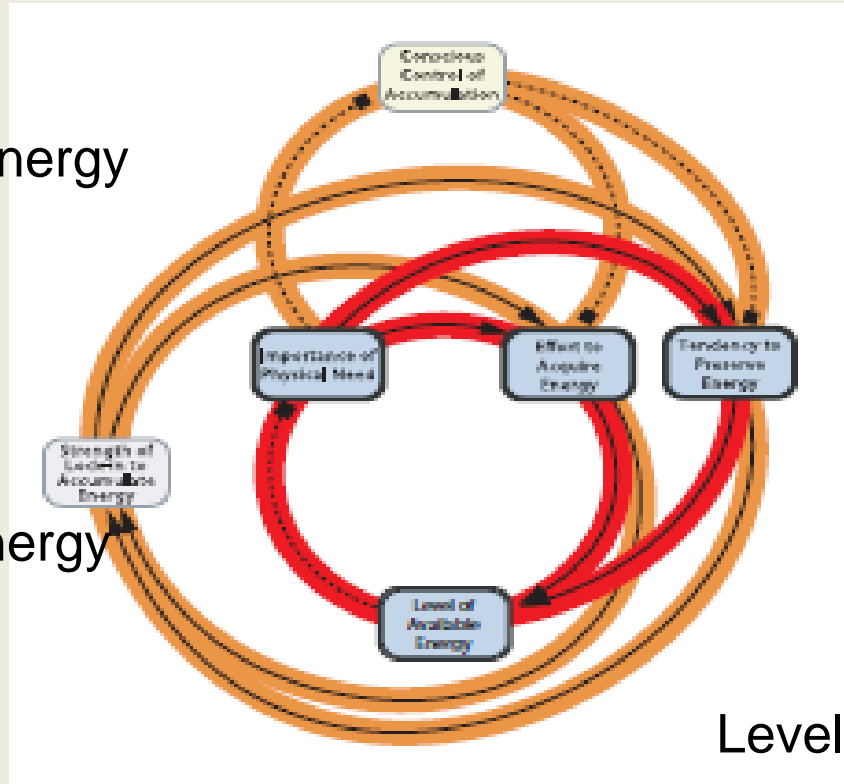
# Individual level variables

Importance of physical need for food

Conscious control of energy accumulation

Effort to acquire food

Strength of lock-in to accumulate energy



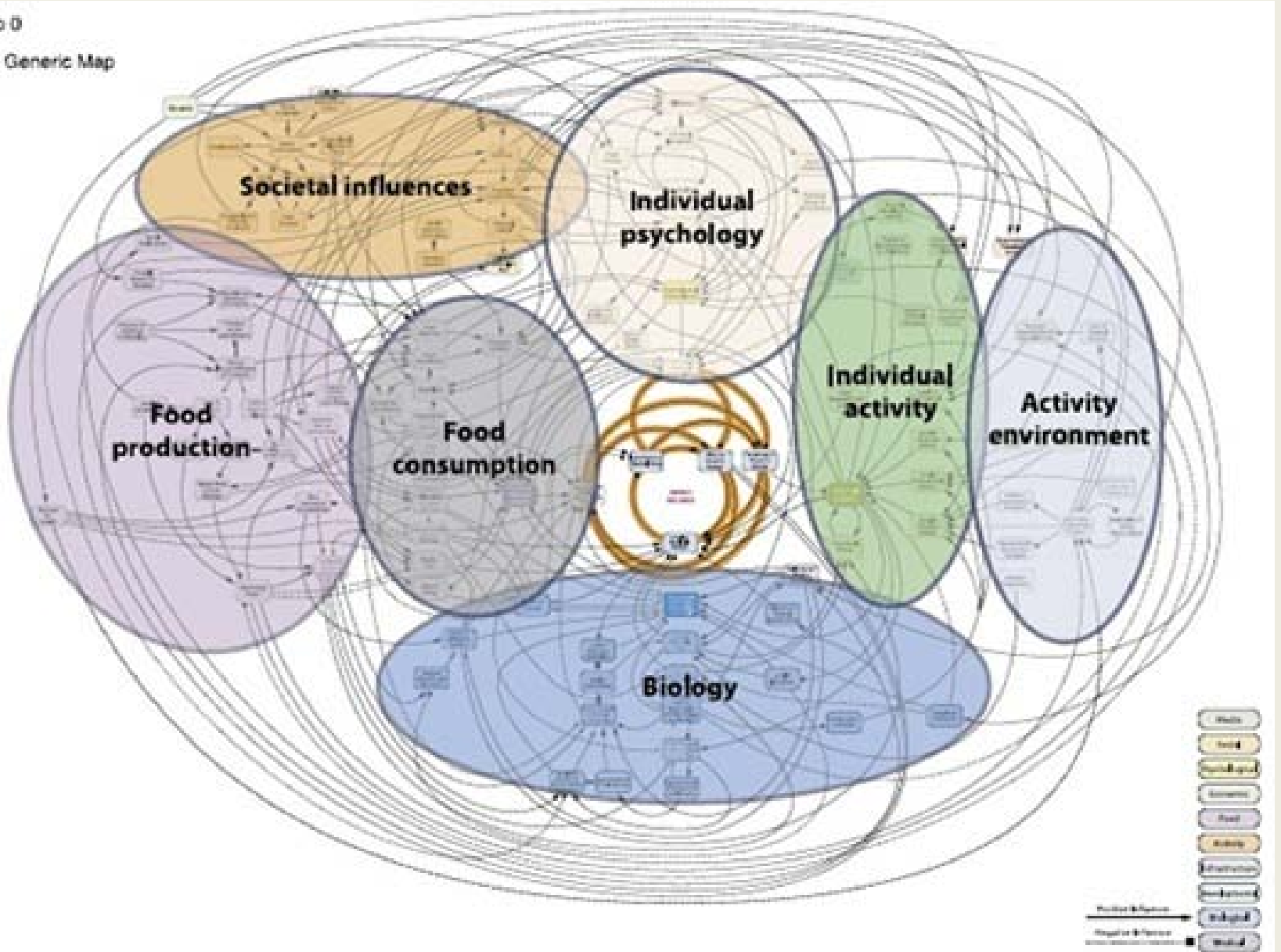
Tendency to preserve energy

Level of available energy

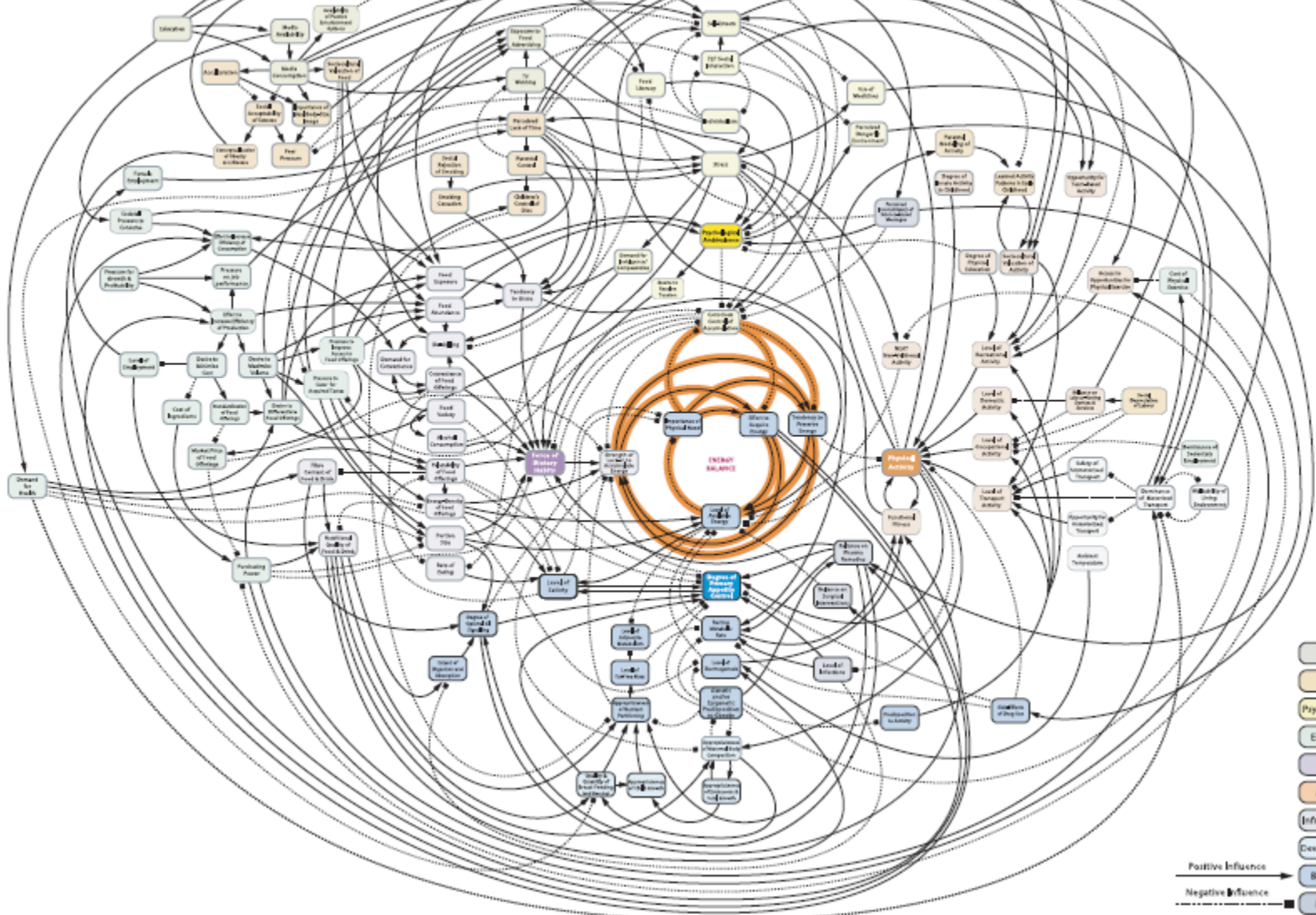
## Foresight obesity model

Map 0

Full Generic Map



# Generic Map





# Why do this?

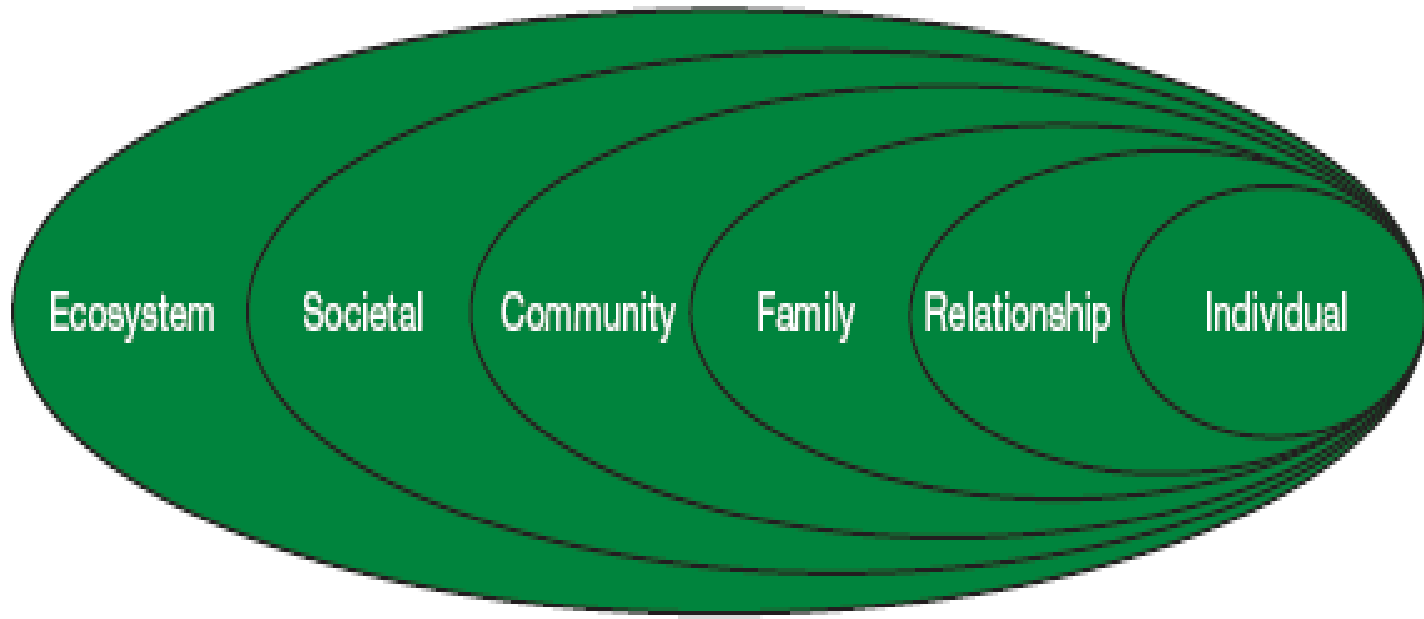
- **to acknowledge, communicate complexity**
  - confirms the multi-level, systemic nature of the problem
  - highlights the need for broad and diversified efforts to study and change the dynamics of the system.
- **to make sense of complexity.**
  - defines a system architecture
  - helps to identify what's relevant and aids thinking about further study and interventions

# Why do this?

- **to support the development of strategies to study and intervene**
  - suggests ways and places to intervene most effectively in the system: **leverage points, feedback loops, and causal cascades**, among others

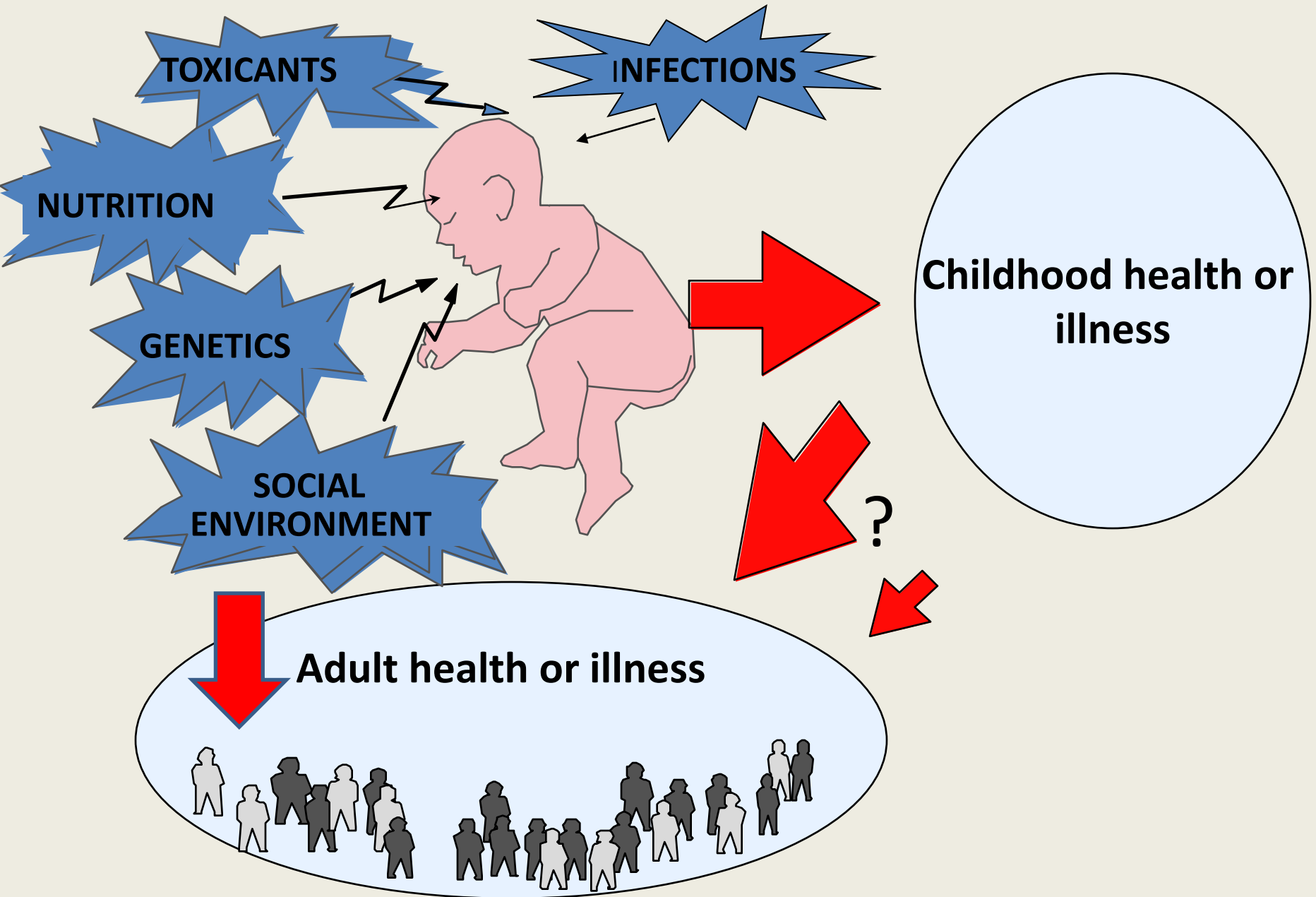
**Complex systems cannot be micromanaged;  
Rather we interact with them in ways that shift  
system dynamics in favorable ways.**

# Ecological (eco-social) framework

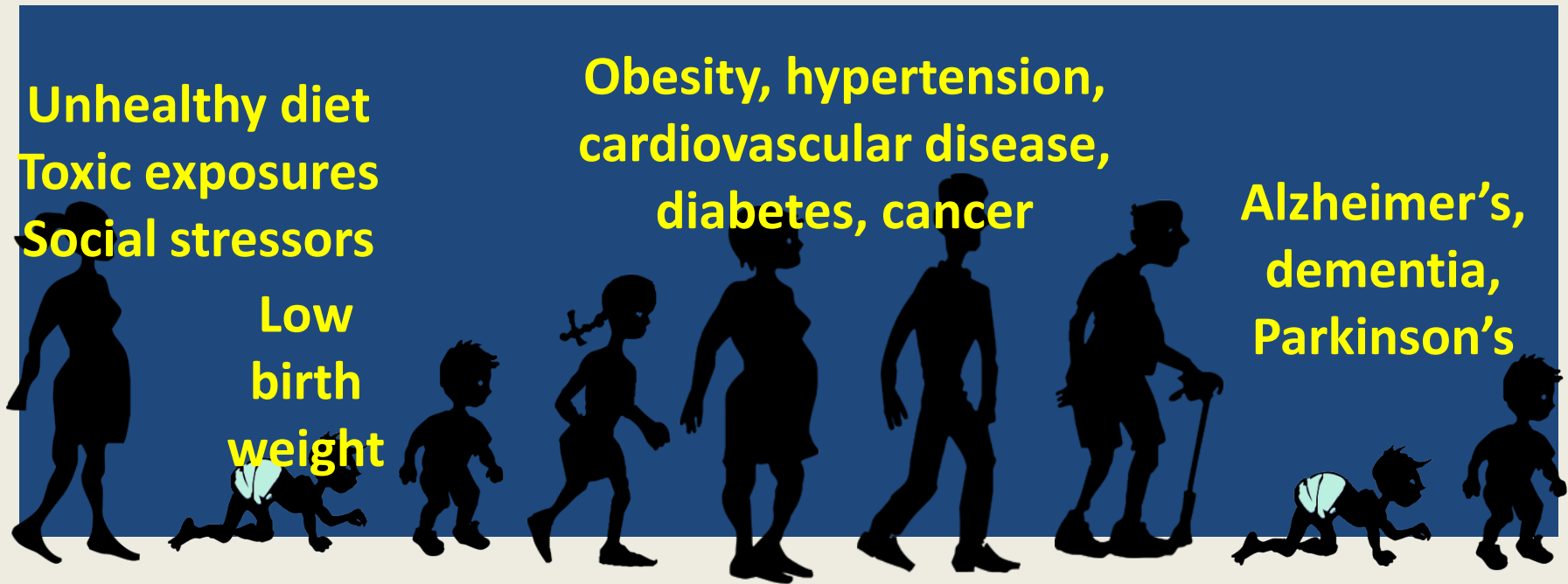


**Multi-level “nesting”**

# Lifecourse perspective



# Early life experiences influence later-life health, disease risks



*Aging begins at conception*

# US food consumption

- 300 more daily calories than 25 yrs. ago
- Calories from added fats and oils increased by 69 percent over 40 yrs.
- Sugar and sweeteners are about 36-40 % of the growing consumption of carbohydrates.
- Fewer than  $\frac{1}{4}$  of people in the US eat at least five servings of fruits and vegetables daily
- Meat consumption in the US is among the top three countries in the world. 22% is processed.

# Nutrition and Chronic Disease

- Increase risks
  - trans fats and many saturated fats
  - high glycemic carbohydrates
  - lack of fruits/vegetables/omega 3s
  - excessive meat
- Reduce risks
  - fruits, vegetables, nuts
  - fish
  - omega 3s, monounsaturated fats
  - low glycemic carbohydrate
  - Mediterranean diet



# Diet and chronic disease risk

- Mediterranean-like diet
  - Intervention studies:
    - 50-70% reduction in cardiovascular related events, mortality;
    - insulin resistance; diabetes, particularly combined with exercise (150 min. moderate intensity weekly)
  - Decreased risk of various kinds of cancer



# Childhood, adolescent diet and breast cancer

- ↑ whole soy food in childhood and adolescence > 50% decreased breast cancer risk
- ↑ meat in adolescence > 35% increased pre-menopausal breast cancer risk (NHS II)
- ↑ dietary vegetable protein, fat, nuts in girls 9-15 associated with decreased risk of benign breast disease at age 30 (Growing Up Today Study)

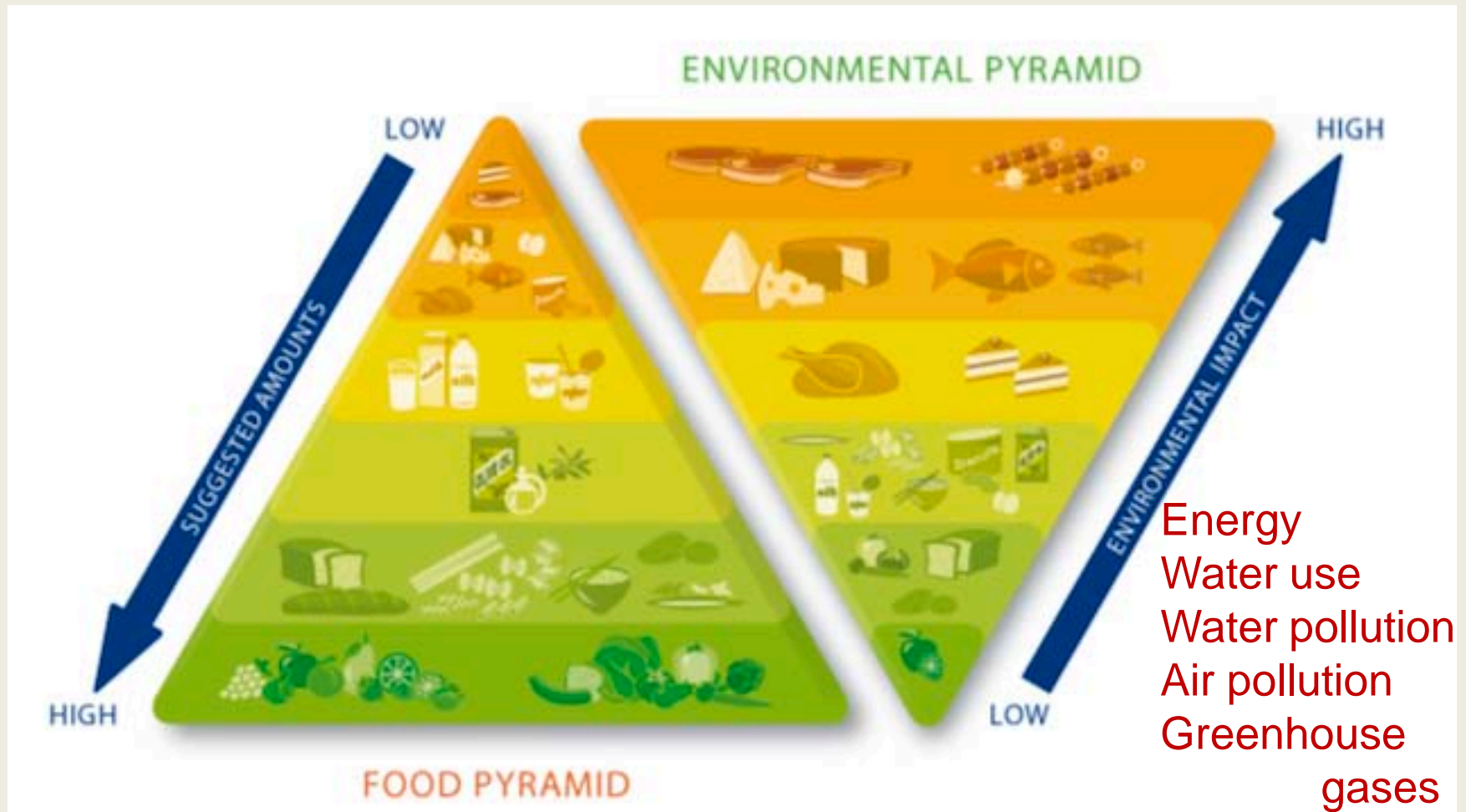
# The environment and vitamin D

- Inadequate vitamin D status is common
- 30-50% of US population have insufficient levels (Endocrine Society; IOM committee)
- Obese /overweight children much more likely to have low levels
- Diverse consequences (bone, breast, immune)
- ACOG: screen women at risk and supplement
- American Academy of Pediatrics: ALL infants receive a vitamin D supplement

# Global food system

- Accounts for approximately one third of all climate changing green house gas emissions through land use change and direct emissions
- Farm animal production accounts for about 18% of global greenhouse gas emissions
- A major contributor to unsustainable, excessive water consumption. Livestock alone accounts for more than 8 percent of global water use.

# Interconnections Between Nutrition and Environmental Impacts



# Environmental chemicals

- The US produces or imports 42 billion pounds of chemicals daily
- Used in countless consumer products
- About 3000 chemicals are produced or used at > one million pounds per year
- Carcinogens, reproductive/developmental, neurological hazards
- Thousands of inadequately-tested and poorly-regulated substances

# Environmental chemical and contaminant exposures

- Exposures are common (CDC biomonitoring)
- **Pesticides**: adverse impact on neurodevelopment, increase Parkinson's disease risk, cancer
- **Endocrine disruptors**: e.g. bisphenol A: prenatal exposures (? prostate and breast cancer risks)
- **Lead, mercury, other metals**
- **Air pollution**: low birth weight, cardiovascular disease, asthma, diabetes, cognitive decline

## ACOG Committee Opinion: Exposure to Toxic Environmental Agents

Prenatal exposure to certain chemicals is associated with:

- Stillbirth
- Miscarriage
- Birth defects
- Childhood cancers
- Impaired brain development in children

Reduce your exposure to environmental chemicals before and during pregnancy:

- Limit processed foods
- Use BPA-free products
- Limit foods high in animal fat
- Avoid pesticides and solvents
- Wash fresh fruits and vegetables
- Avoid fish with high mercury levels

# Health Benefits of Physical Activity

**Increasing physical activity at all ages improves physical and emotional wellbeing.**

- Improved insulin sensitivity; > 50% reduced risk of diabetes when combined with healthy diet (NEJM; 2002)
- Improved cardiovascular health
- Reduced risk of cognitive decline and dementia
- Reduced risk of cancer
- A component of weight control





# Personal correlates with activity levels

- In adolescents, increased physical activity levels correlate with:
  - being male, higher previous physical activity levels, confidence in ability, family and social support.
- In adults:
  - health status and confidence in ability
  - personal history of physical activity

(Bauman, Lancet, 2012; Altonen, Scand J Med Sci Sports , 2013; Ding, Am J Prev Med, 2011)

# Environmental correlates with physical activity levels

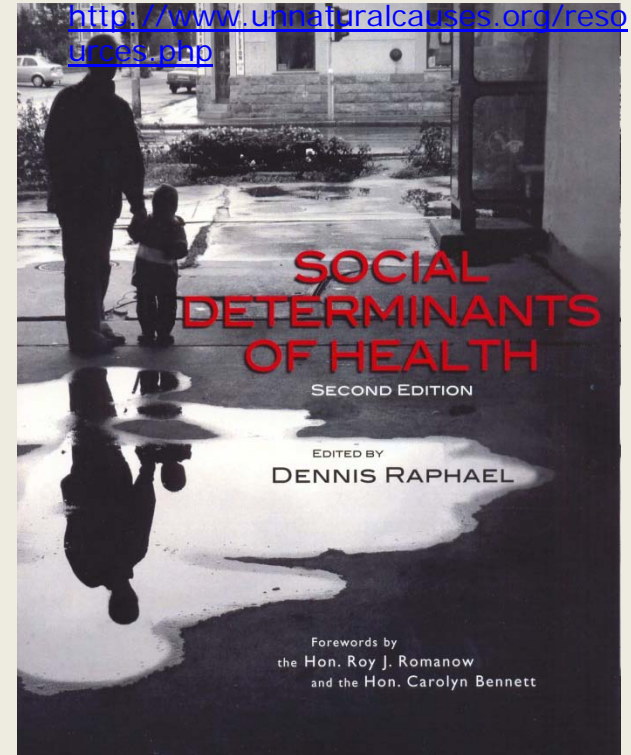
- Children, young people
  - neighborhood walkability,
  - traffic speed and volume,
  - transportation environment
  - land-use mix (proximity of homes and destinations such as shops),
  - residential density,
  - access or proximity to recreation facilities

# Environmental correlates with physical activity levels

- For adults—strongest associations:
  - availability and location of recreation facilities,
  - the transportation environment,
  - aesthetics

# Socioeconomic, Psychosocial Environment

- Lower socioeconomic status →  
↑ risk of impaired neurodevelopment, cardiovascular disease, diabetes, obesity, metabolic syndrome, Alzheimer's disease, many kinds of cancer, asthma.
- Due to: Combinations of increased exposures to hazards, increased susceptibility, decreased capacity to cope and recover.
- Elevated baseline levels of inflammatory markers, stress hormones



# Design problems

Our individual and collective activities, choices, and policies have designed many of these problems into the fabric of our communities and society

# An individual approach to preventing illness

## Personal Level – “Approaches to Healthy Living”

- ◆ Eat healthy food– whole, fresh, unprocessed, plant based
- ◆ Avoid hazardous chemical exposures whenever possible
- ◆ Exercise
- ◆ Be socially engaged



# Re-designing for individual, community ,and environmental health

- **Regional, diversified and sustainable food production;** reconfiguration of crop subsidies and insurance programs
- **Clean, renewable energy** → ↓ air pollution, chemical exposures
- Partnerships to improve **active transport and recreation programs**
- **Chemical policy regulatory reform; Safer substitute programs and green product design**
- Address **socioeconomic disparities** in policy development