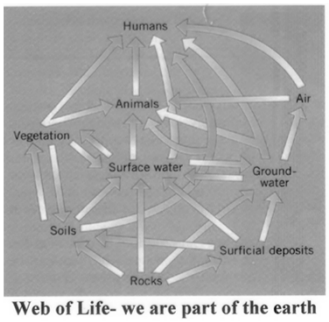
Environmental Hazards & Human Health

CHAPTER 18

Toxicology, Risk, & Health

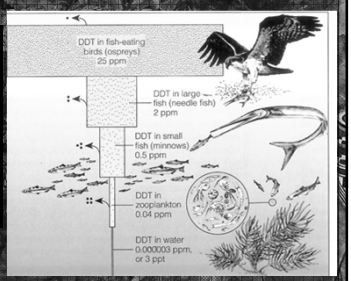


Web of Life- we are part of the earth

Does it magnify in the trophic pyramid?

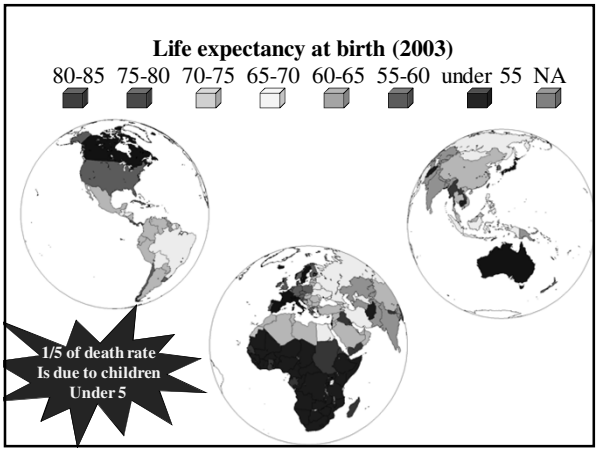
Biomagnification

- Fat-soluble compounds
- DDT
- PCB's



Does it accumulate in our body?
Bioaccumulation

- **Increased concentration in specific tissues or organs**
- **Red tide – Florida Manatee's & other marine organisms**
- **Dioxin- persistent toxic chemical used to make paper (chlorination) and PVC plastic**
- **Asbestos- mineral fiber used for insulation and fire-retardant**
- **Mercury**



Leading causes of mortality in developing and developed countries 1998

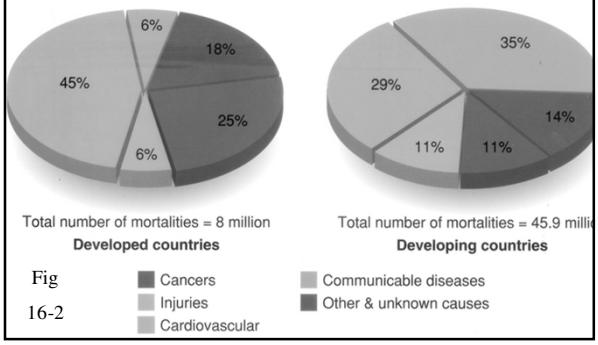


Fig 16-2

Hazards in the Environment

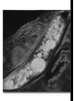
Cultural Hazards

- Unsafe working conditions
- Poor diet
- Drugs, drinking, driving
- Poverty

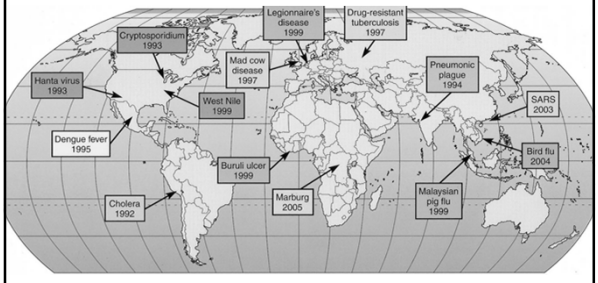
Biological Hazards

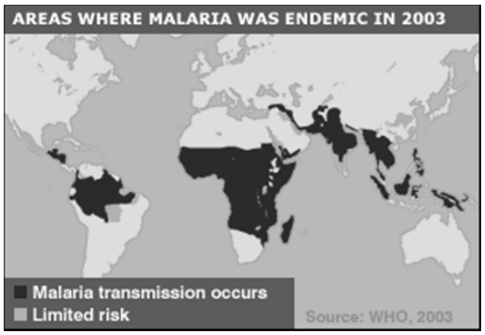
- **Plagues- *Yersinia pestis-* Black Death**
- **Cholera- in copepods increases during El Nino**
- **Malaria- *Anopheles* Mosquito**
- **Tuberculosis- Mycobacterium tuberculosis**
- **Overuse of Antibiotics**

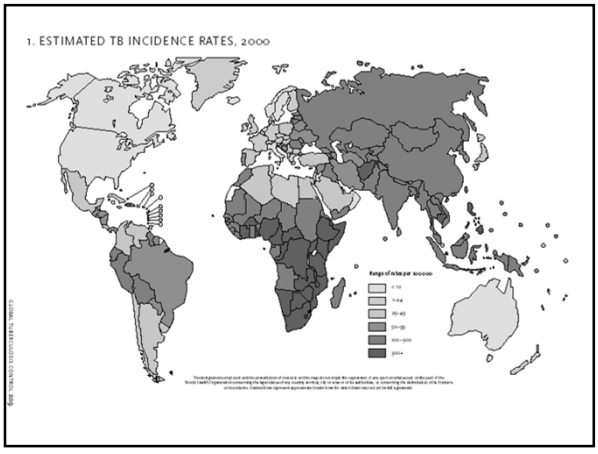


Global Health Outbreaks



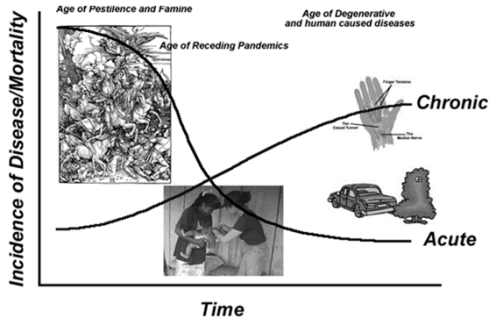




The Growing Threat of Tuberculosis

- Lack of TB screening and control programs in developing countries where 95% of the new cases occur
- Most strains of the TB bacterium have developed genetic resistance to most of the effective antibiotics
- Weakened AIDS patients develop TB

Epidemiological Transition



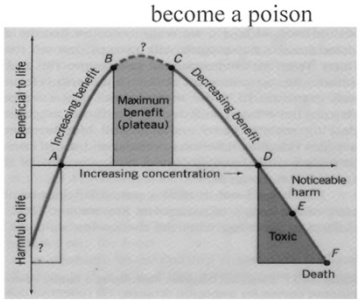
Will the Bird Flu (H5N1) Be the Next Epidemic?

The World's Top Five Deadliest Diseases

Chemical Hazards- Industrialization

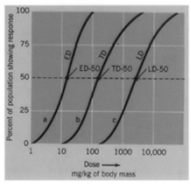
- **Mutagens**
- **Carcinogens- cigarette smoke!**
- **Neurotoxins- DDT, PCB's, organophosphates, formaldehyde, dioxin**
- **Hormone Disruptors- dioxin, CB's, lead**
- **Depends upon the persitence of the compound**
- **Oil-or fat-soluble toxins can penetrate cell membrane**

Dose-Response Curve- at what point does the substance become a poison



How do we Estimate Toxicity?

Toxicity ratings are based on the average lethal dose



ED-effective dose
TD-toxic dose to
LD- lethal dose

Note: overlap of curves due differences in body size

2004 EPA Top 5 toxic substances

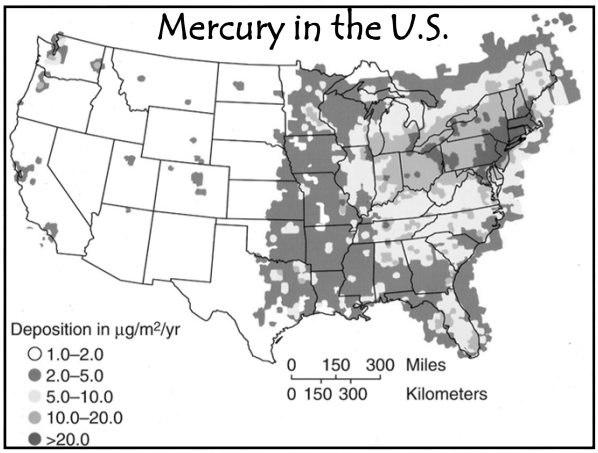
1. **Arsenic**
2. **Lead**
3. **Mercury**
4. **Vinyl chloride (used to make PVC plastic)**
5. **Polychlorinated** biphenyls (PCB's)

Mercury
The Hatters Disease

200 years ago, the furs used to make beaver felt hats was dipped into mercury nitrate solution as a preservative and to soften the animal hairs. Unfortunately the workers in the felt hat trade absorbed mercury through their skins; the resulting mercury poisoning caused shaking and slurred speech

Mercury

- Mercury is a neurotoxin, meaning it affects the nervous system, it effects the cognitive development of children
- It causes fatal heart attacks in adults
- Mercury vapors from gold mining are causing brain damage in the children of Nambija
- mercury from the burning of fossil fuels escapes into the environment and changes into methylmercury, it is ingested by fish. Mercury-contaminated fish are the most likely source of mercury poisoning



The current EPA reduction of mercury released by the burning of coal has been criticized by the Harvard Center for Risk Analysis, the rule calls for a reduction from the current 48 tons a year to 15 tons a year by 2018

Mercury is Bioaccumulated in the body
Pregnant woman should not eat sushi or tuna!

Safe Harbor Seafood
A company that tests fish for mercury and only certifies fish with low levels of mercury

Risk Assessment

Risk- a measure of the likelihood that you will suffer harm from a hazard

Begun by the EPA in the mid 1970's for cancer risk

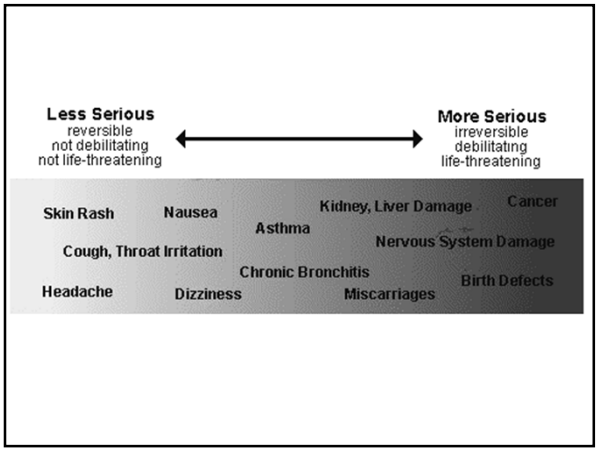
What is the probability of harm to human health, society, or the environment?

Risk Management
Is a regulatory action necessary?

- Part of the EPA policy for the last 20 years
- Cost-benefit analysis
- Risk-benefit analysis
- Public Preferences- risk perceptions

Comparative risk analysis of ecological and health problems

	Scientists (Not in rank order in each category)	Citizens (In rank order)
	High-Risk Health Problems • Indoor air pollution • Outdoor air pollution • Worker exposure to industrial or farm chemicals • Pollutants in drinking water • Pesticide residues on food • Toxic chemicals in consumer products **High-Risk Ecological Problems** • Global climate change • Stratospheric ozone depletion • Wildlife habitat alteration and destruction • Species extinction and loss of biodiversity	**High-Risk Problems** • Hazardous waste sites • Industrial water pollution • Occupational exposure to chemicals • Oil spills • Stratospheric ozone depletion • Nuclear power-plant accidents • Industrial accidents releasing pollutants • Radioactive wastes • Air pollution from factories • Leaking underground tanks
	Medium-Risk Ecological Problems • Acid deposition • Pesticides • Airborne toxic chemicals • Toxic chemicals, nutrients, and sediment in surface waters	**Medium-Risk Problems** • Coastal water contamination • Solid waste and litter • Pesticide risks to farm workers • Water pollution from sewage plants
	Low-Risk Ecological Problems • Oil spills • Groundwater pollution • Radioactive isotopes • Acid runoff to surface waters • Thermal pollution	**Low-Risk Problems** • Air pollution from vehicles • Pesticide residues in foods • Global climate change • Drinking water contamination



Neurotoxins

- Create behavioral changes
- Learning disabilities
- Attention deficit disorder
- death

Endocrine disruptors

- DDT - pesticide
- PCB's -
- Atrazine - herbicide
- Bisphenol A – hard plastics
- Phthalates- cosmetics

Where an activity raises threats of harm to human health, or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically.

In this context, the proponent of an activity, rather than the public, should bear the burden of proof

Indoor Air Pollution