Cancer and the Environment: Reflections from Cancer Alley

Tom Burke
Professor
Johns Hopkins University
Bloomberg School of Public Health

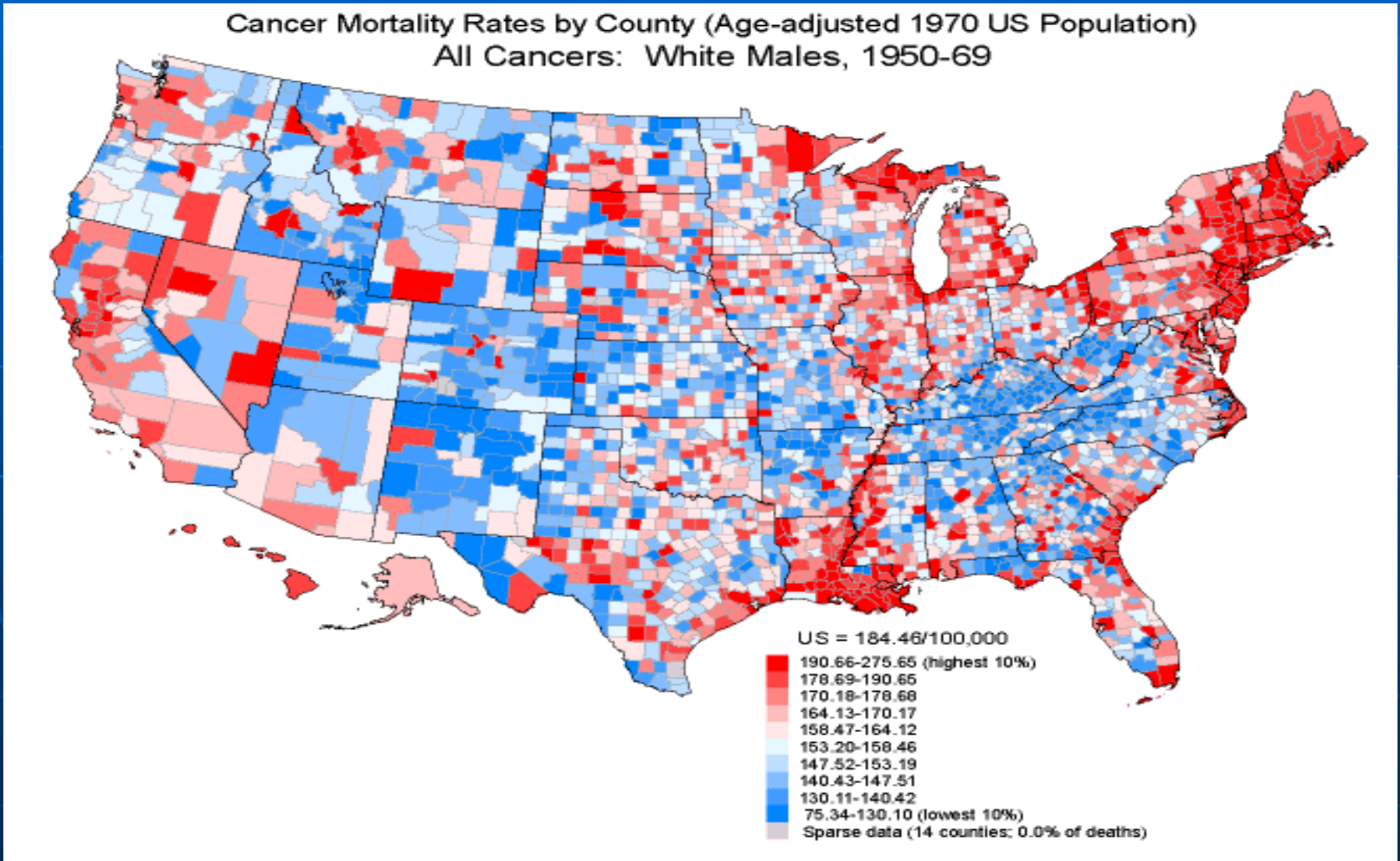
Overview

- Reflections on experiences
- Cancer Alley
- Cluster Investigations
- Environmental Exposures
- Future Directions
- Getting to Prevention

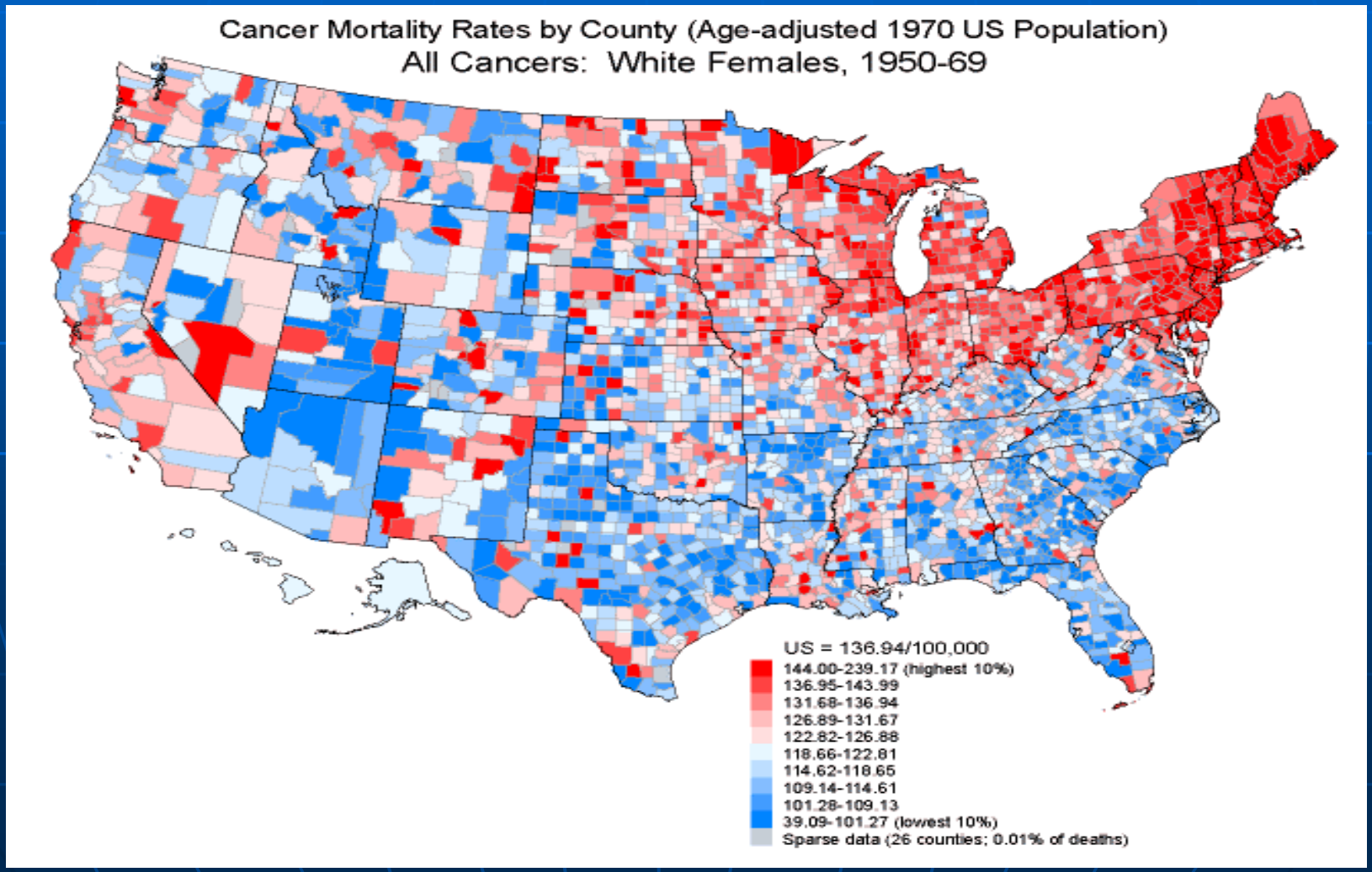
Environmental Cancer

- 2 -5% (Doll and Peto, 1981)
- 70 – 80%
- A Political Disease?

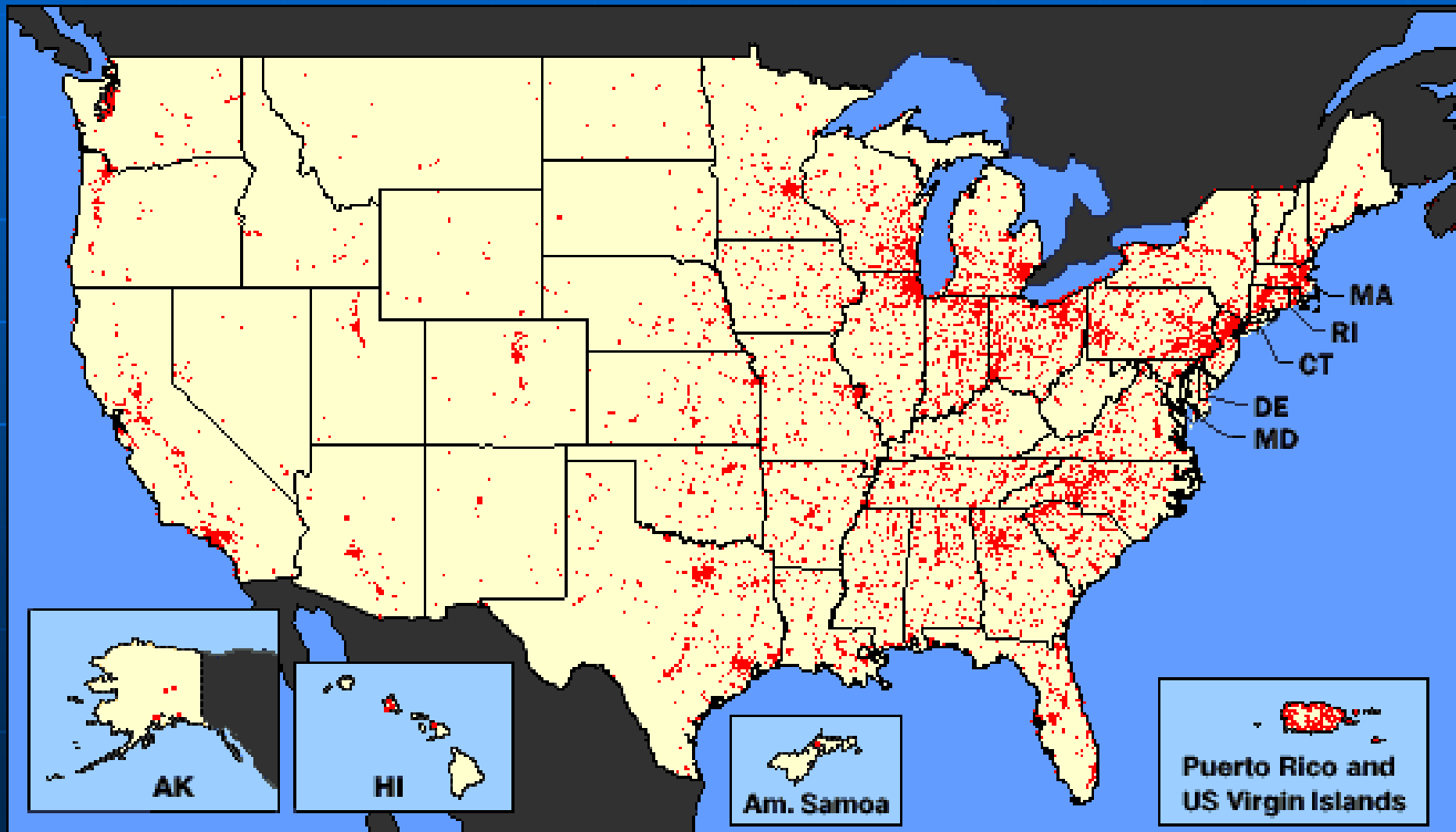
Male Cancer Mortality 1950-1969



Female Cancer Mortality 1950-1969



Major Toxics Sources



The Challenges

- Asbestos
- Industrial Emissions
- Ground water and drinking water
- Toxic Waste sites
- Radium
- Radon
- PCBs
- Dioxin
- Chromium
- Clusters

The Pierpont School

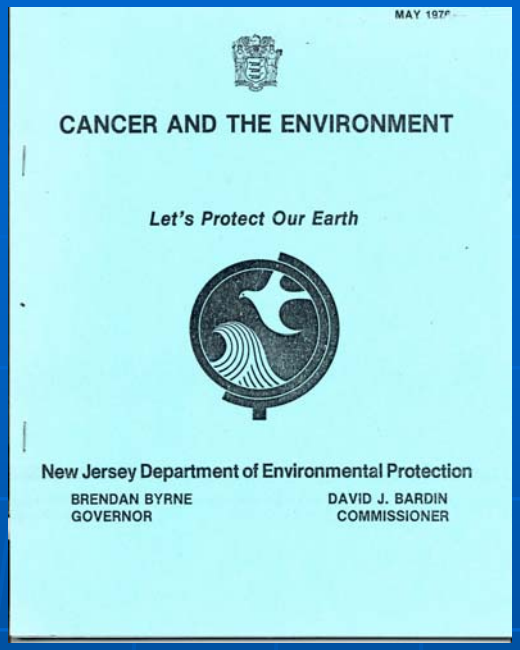
An environmental investigation of clusters of leukemia and Hodgkin's disease in Rutherford, New Jersey. Journal of the Medical Society

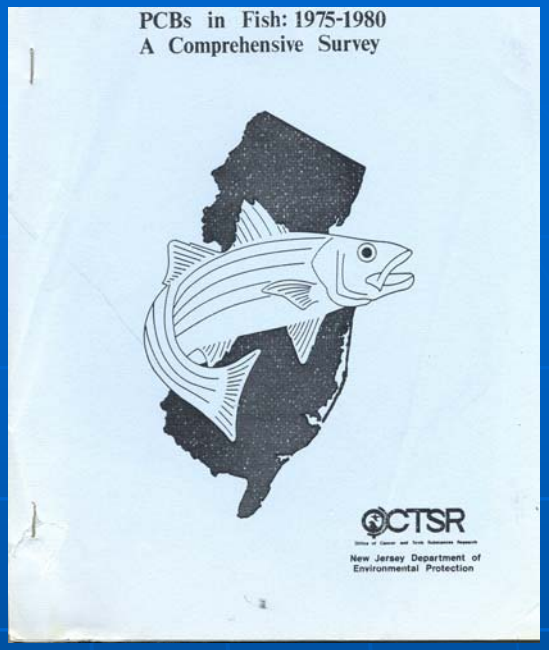
Burke, T. A., Gray, S., Katz, R., Krawiec, C., & Preuss, P. (1980). of New Jersey, 77, 259-264.

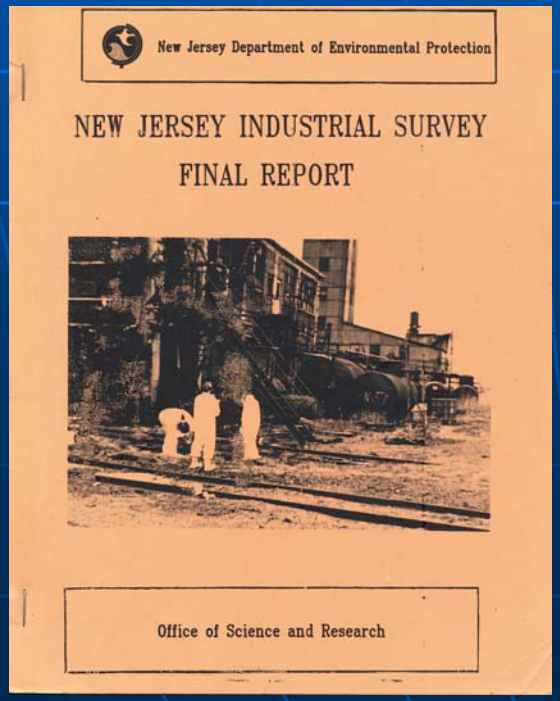
Chromium History

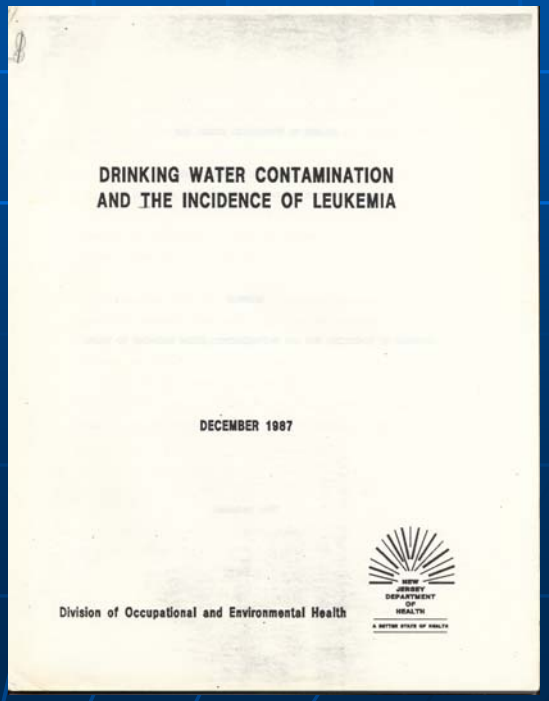
- 1897-1971: Three companies processed chromite ore in Hudson County, NJ
- 1897-1971: About 2 million tons of chromite ore processing residue (COPR) used as landfill in Hudson Co.
- 1983: Concern first raised about potential cancer risk posed by Cr(VI) in COPR in soils

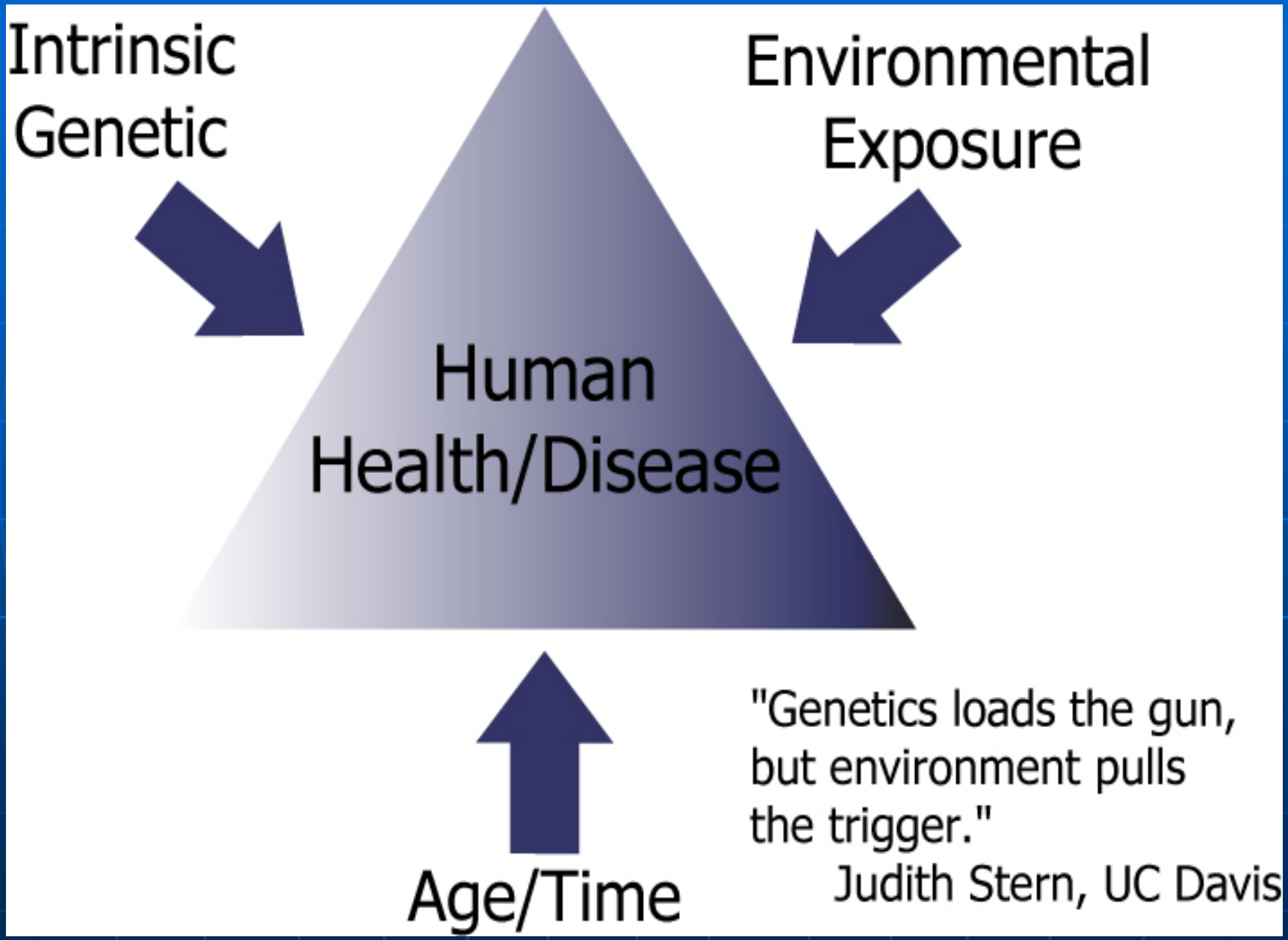
Roots…..


MAY 1976
CANCER AND THE ENVIRONMENT
Let's Protect Our Earth
New Jersey Department of Environmental Protection
BRENDAN BYRNE
GOVERNOR
DAVID J. BARDIN
COMMISSIONER


PCBs in Fish: 1975-1980
A Comprehensive Survey
CTSR
New Jersey Department of Environmental Protection


New Jersey Department of Environmental Protection
NEW JERSEY INDUSTRIAL SURVEY
FINAL REPORT
Office of Science and Research


DRINKING WATER CONTAMINATION
AND THE INCIDENCE OF LEUKEMIA
DECEMBER 1987
Division of Occupational and Environmental Health



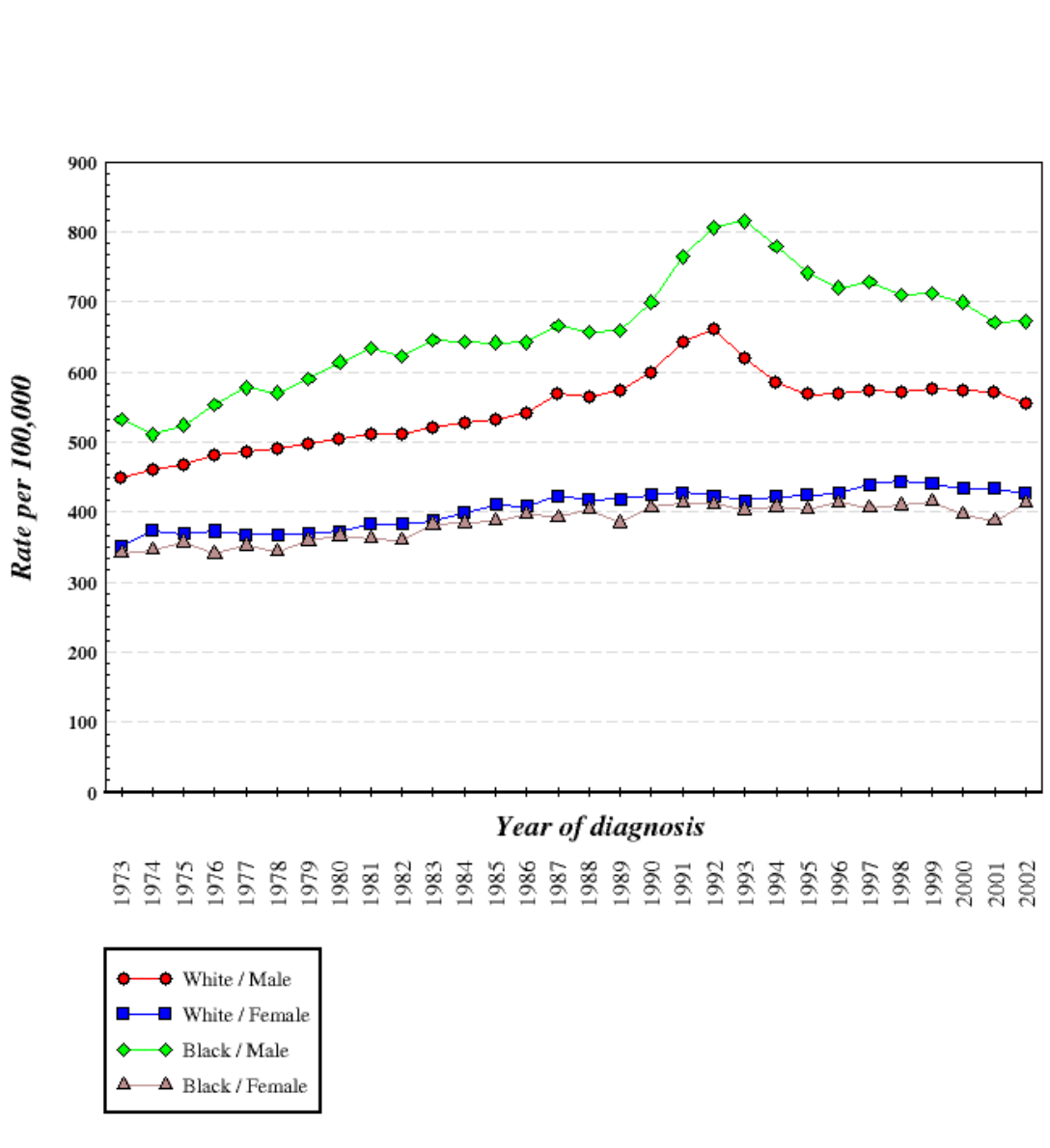
Source: K. Olden (adapted)

Recognized (Suspected) Environmental Cancers

- Leukemia
- Lymphoma
- Myeloma
- Liver
- Lung
- Bladder
- Kidney

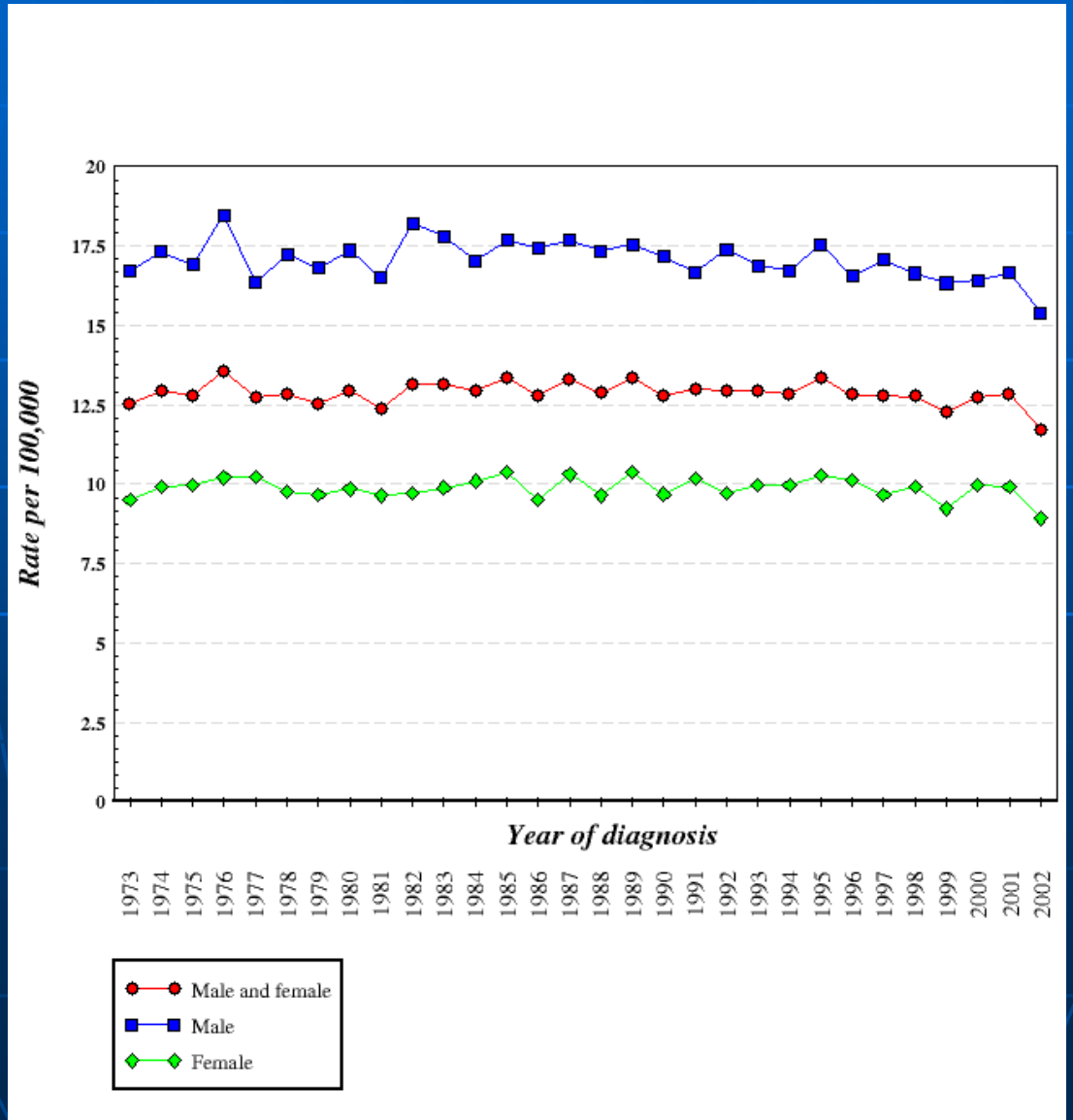
CANCER TYPE	AGENTS	OCCUPATIONS/ ENVIRONMENTS	DATA
BLADDER	Tobacco, aromatic amines (benzidine, 2-naphthylamine, 4-Aminobiphenyl) by-products of chlorination, arsenic, dyes (auramine and magenta), coal tar pitch volatiles	Dyestuffs and rubber industries, cable making industries, leather workers, painters, truck drivers, aluminum workers, chimney sweeps	Evidence is well-established
BRAIN/CNS	Radiation, tobacco (second hand exposure to children), alcohol, nonpublic or spring water, cured meats/fish, coal and petroleum products, EMFs, insecticides/fungicides, herbicides, fertilizers, vinyl chloride, N-nitroso compounds (NOCs), PAHs	Petrochemical workers, rubber industry, health professions (pathologists, physicians, nurses, dentists, veterinarians), electrical workers, railway workers, agriculture	Association with high-dose radiation well-established
KIDNEY	Tobacco, asbestos, alcohol, PAH's, cadmium, inorganic arsenic, radiation, dyes, coal, natural gas, mineral oil	Dry cleaning workers, coke-oven workers, petroleum refinery workers, truck drivers, electric utility workers	Unclear
LEUKEMIA	Benzene, radiation, EMFs, styrene, butadiene, pesticides, herbicides, insecticides, fertilizers, ethylene oxide, diesel exhaust, polynuclear aromatic hydrocarbons, hair dyes, tobacco	X-ray technicians, hydrocarbon-related industry, chemical manufacturing, shoe, leather, rubber and rotoprinting workers, refineries, farmers, embalmers, anatomists, pathologists, welders, foundry workers, hairdressers, dry cleaners, carpet manufacturing, wood products industries	Evidence is well-established
LIVER AND BILE DUCT	Alcohol, tobacco, vinyl chloride, arsenicals, thorotrast, aflatoxins	PVC workers, automotive and rubber plant workers, textile and metalworkers, aircraft, chemical processing and wood-finishing industries, petroleum refining, paper mills, shoemaking and repairs, shipbuilding and insulation work	Evidence is well-established
LUNG AND BRONCHUS	Tobacco, alcohol, arsenic, insecticides, asbestos, man-made mineral fibers, chloromethyl ethers, chromium (VI), mustard gas, nickel, PAHs, radon, silica, vinyl chloride, acrylonitrile, beryllium, formaldehyde, chlorinated toluenes, epoxy resins, pesticides, wood dust, radiation, air pollution, Bis(chloromethyl)ether, chloromethyl methyl ether, coal tar pitch volatiles, sulfuric acid mist	Copper smelting, mining, asbestos industries, chromate-producing industries, nickel refining, steel workers (coke ovens), gas workers, aluminum smelting, roofers, rail workers, rubber workers, welders, paper and pulp industry, butchers and meat packers, cooks and bakers, painters	Evidence is well-established
LYMPHOMA (Non-Hodgkins)	Radiation, herbicides, pesticides, 2,3,7,8-TCDD, styrene, butadiene	Agriculture, rubber industry, woodworkers, meat workers, metal workers	Occupation associations
MULTIPLE MYELOMA	Radiation, asbestos, benzene, pesticides, herbicides, paints, solvents, aromatic and aliphatic hydrocarbons, 2,3,7,8-TCDD, metals, textile fibers, inks and dyes	Agriculture, rubber industries, herbicide applicators, textile industries, plastics manufacturing, wood products industries, cosmetologists and hairdressers	Strong env. associations

SEER Age Adjusted Incidence Rates by Race and Sex
All Cancer Sites, All Ages

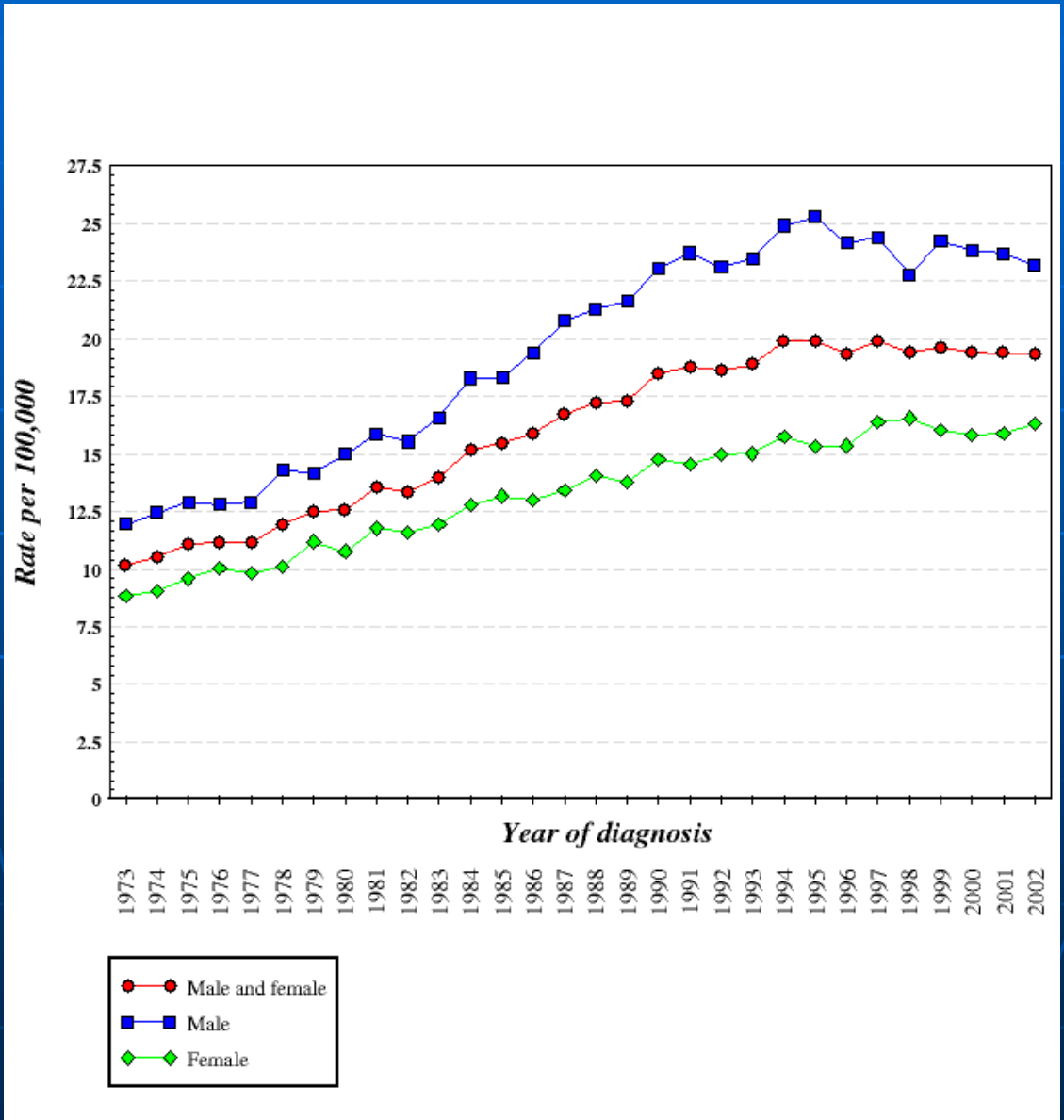


SEER Age Adjusted Incidence Rates

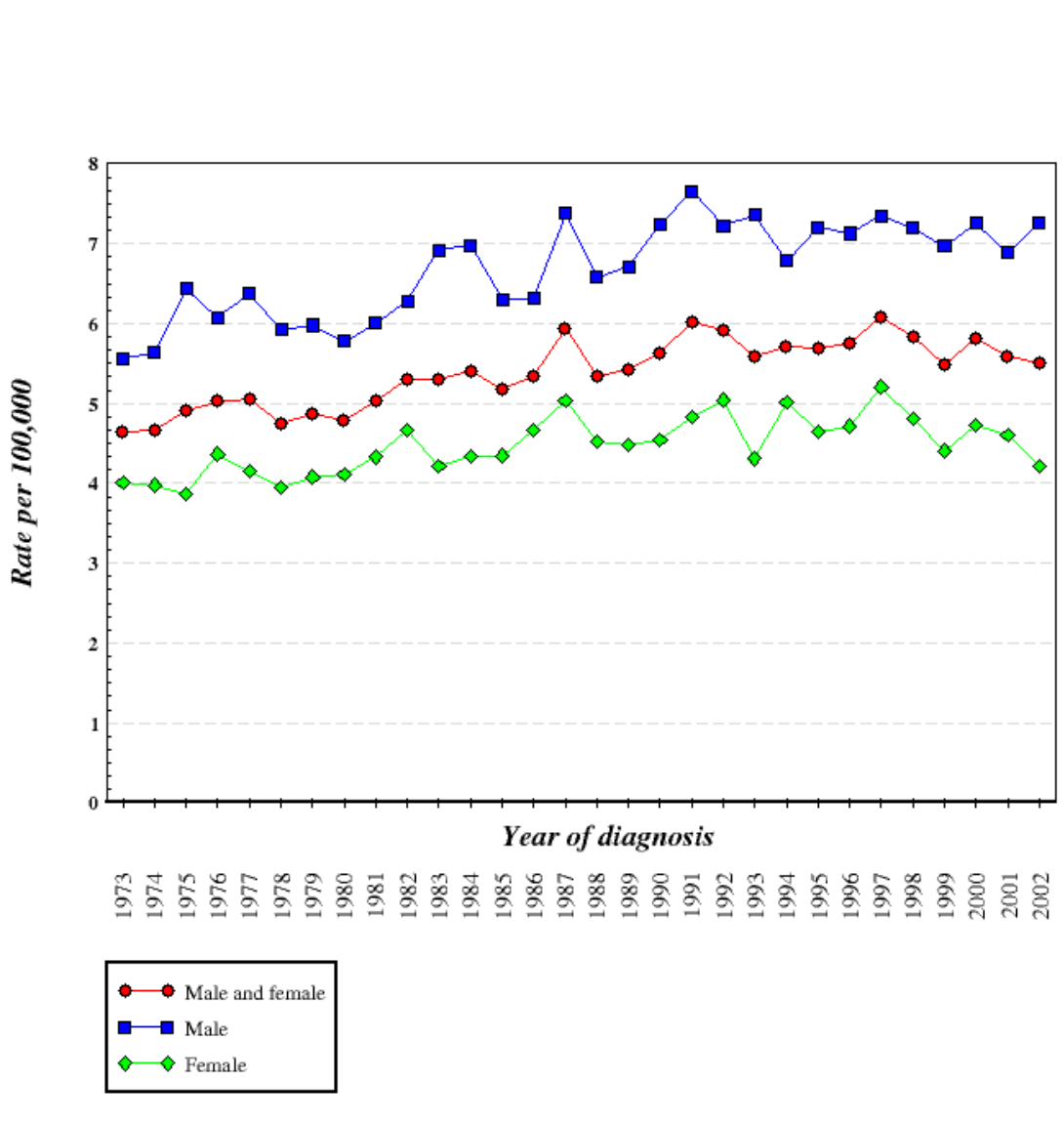
Leukemia, All Ages SEER 9 Registries for 1973-2002



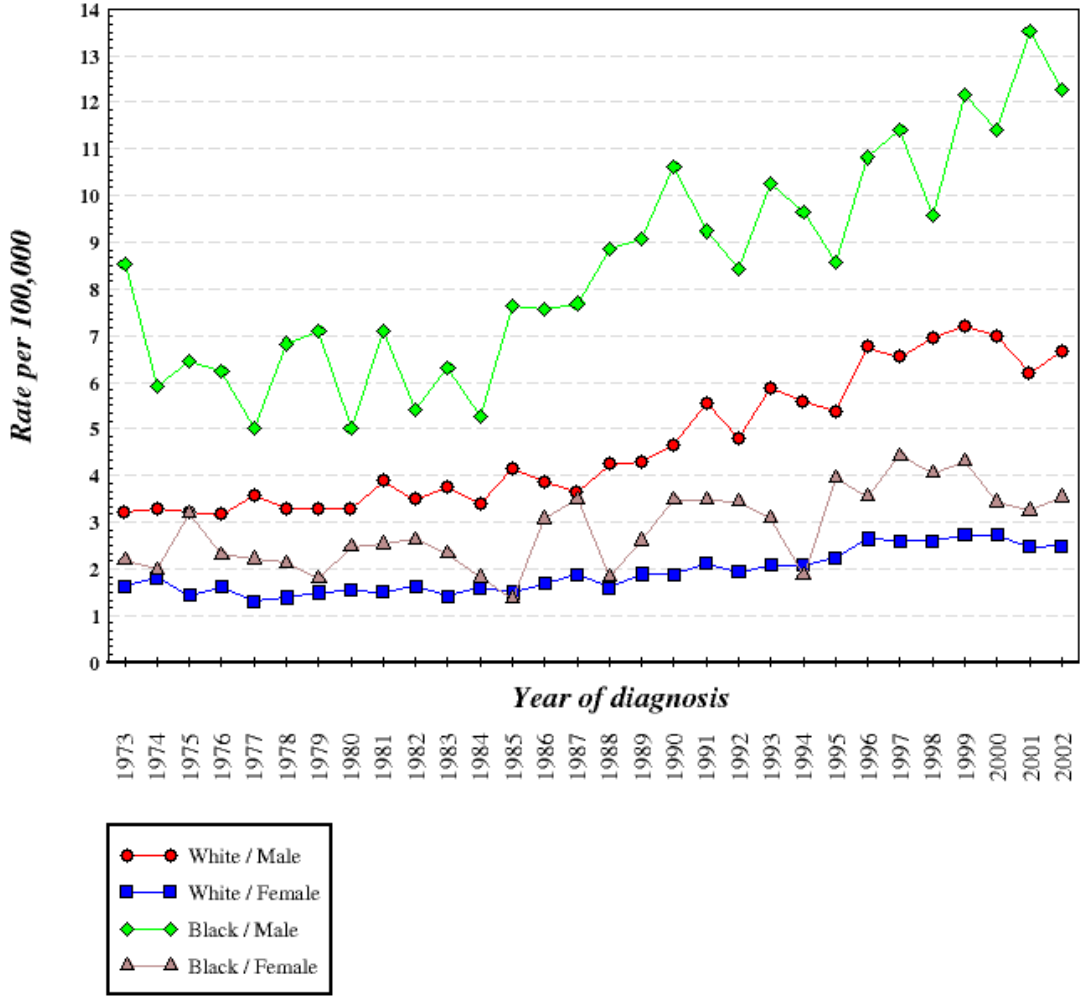
SEER Age Adjusted Incidence Rates by Sex
Non-Hodgkin Lymphoma, All Ages



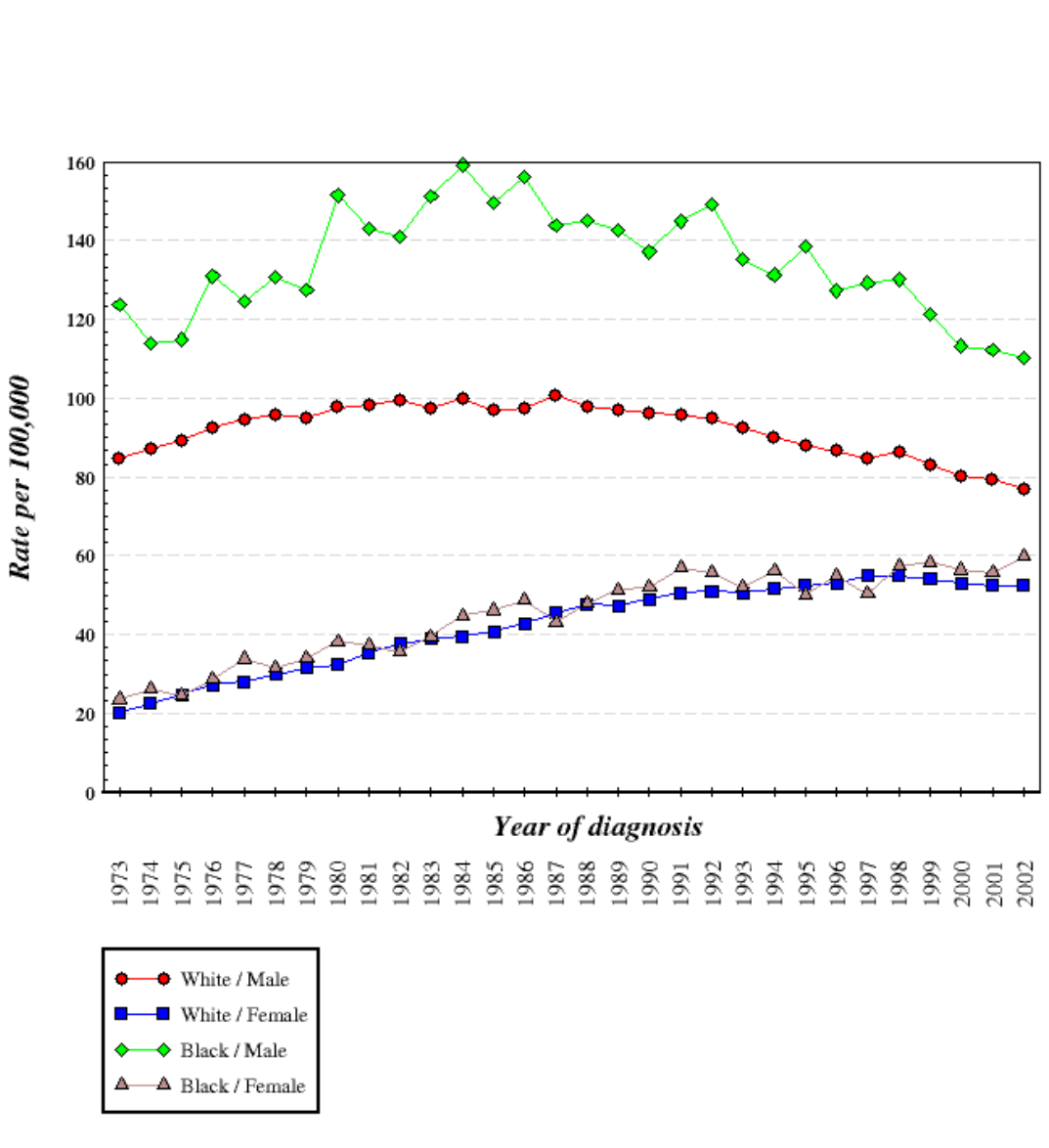
Myeloma Trends



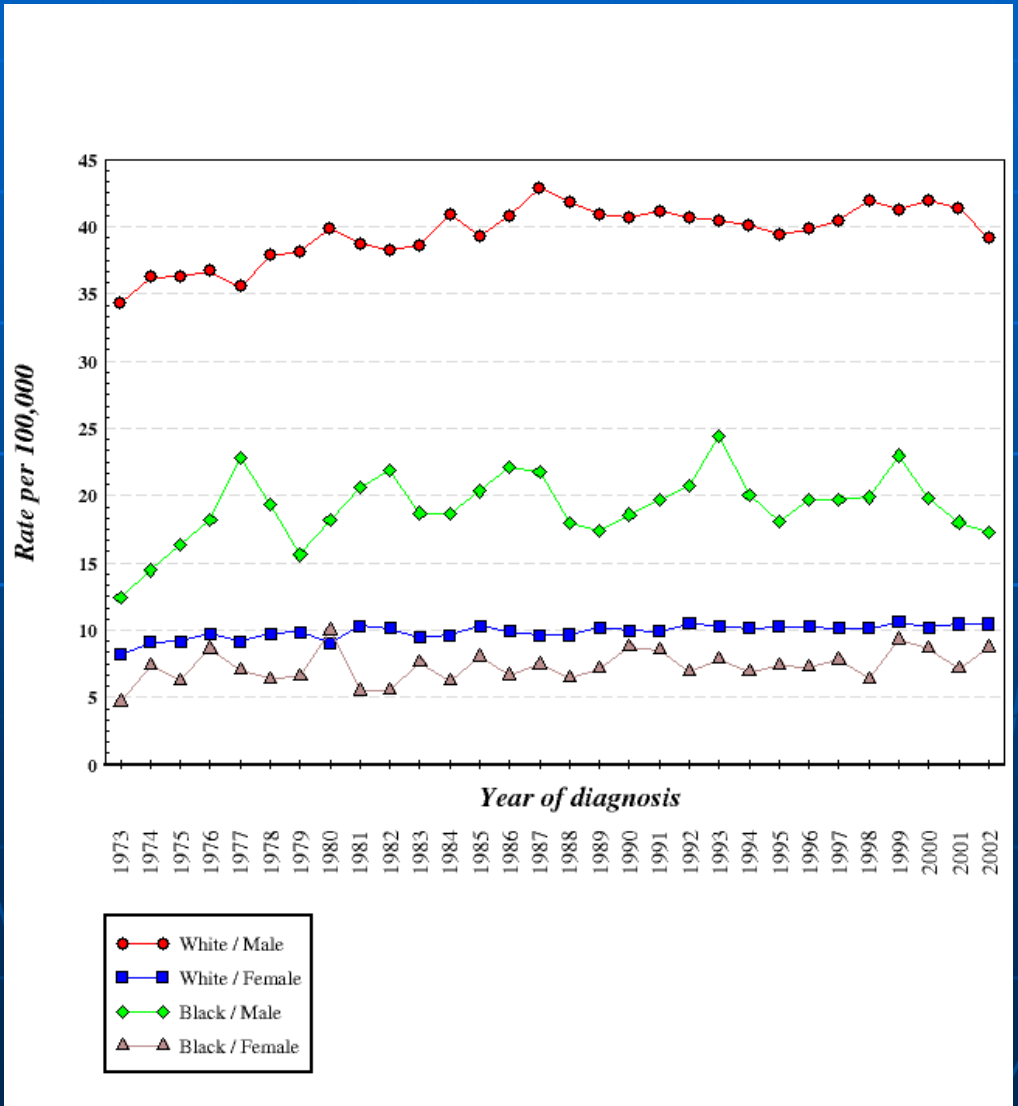
Liver Cancer Trends



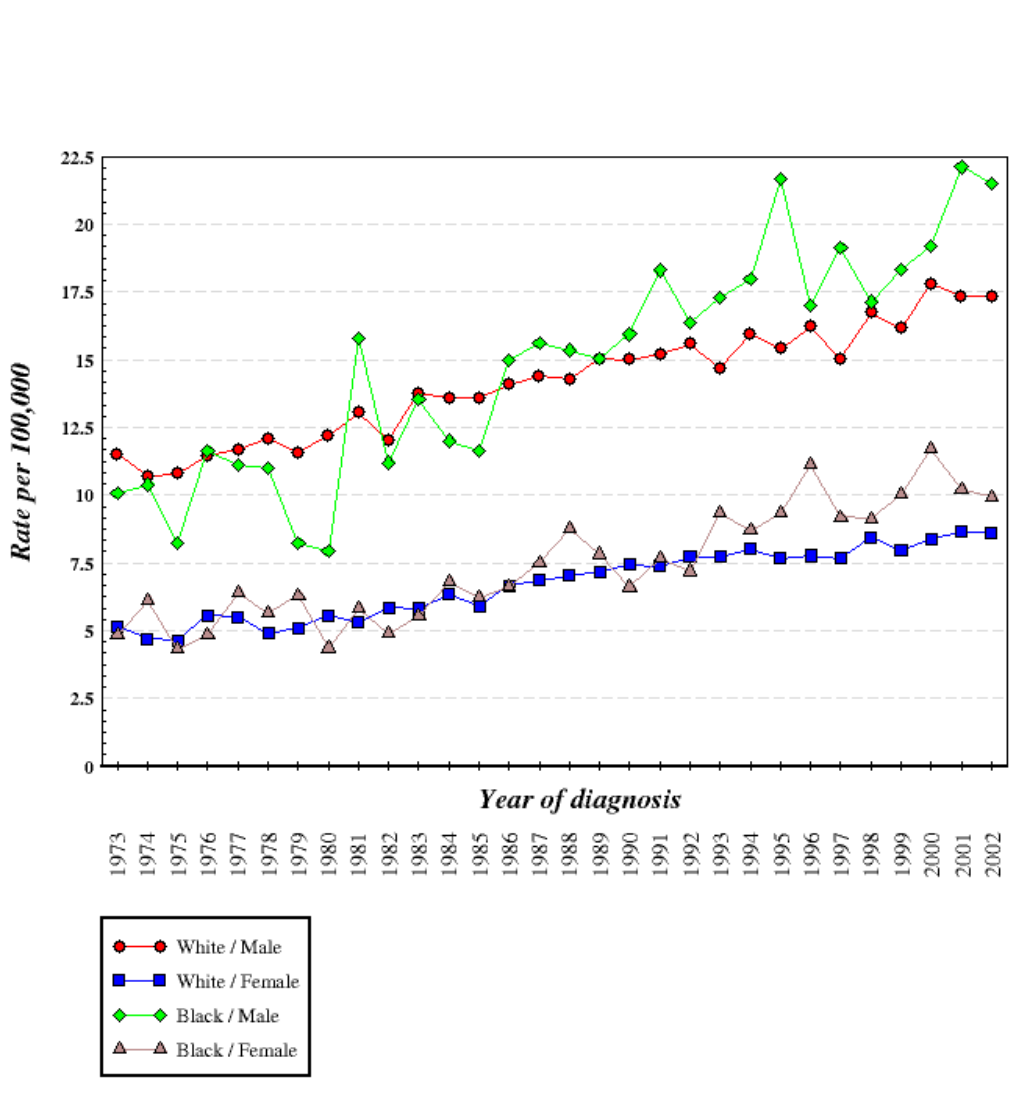
Lung Cancer Trends



Bladder Cancer Trends



Kidney Cancer Trends



SEER Age Adjusted Incidence Rates by Sex
Brain and Other Nervous System Cancer, All Ages
SEER 9 Registries for 1973-2002

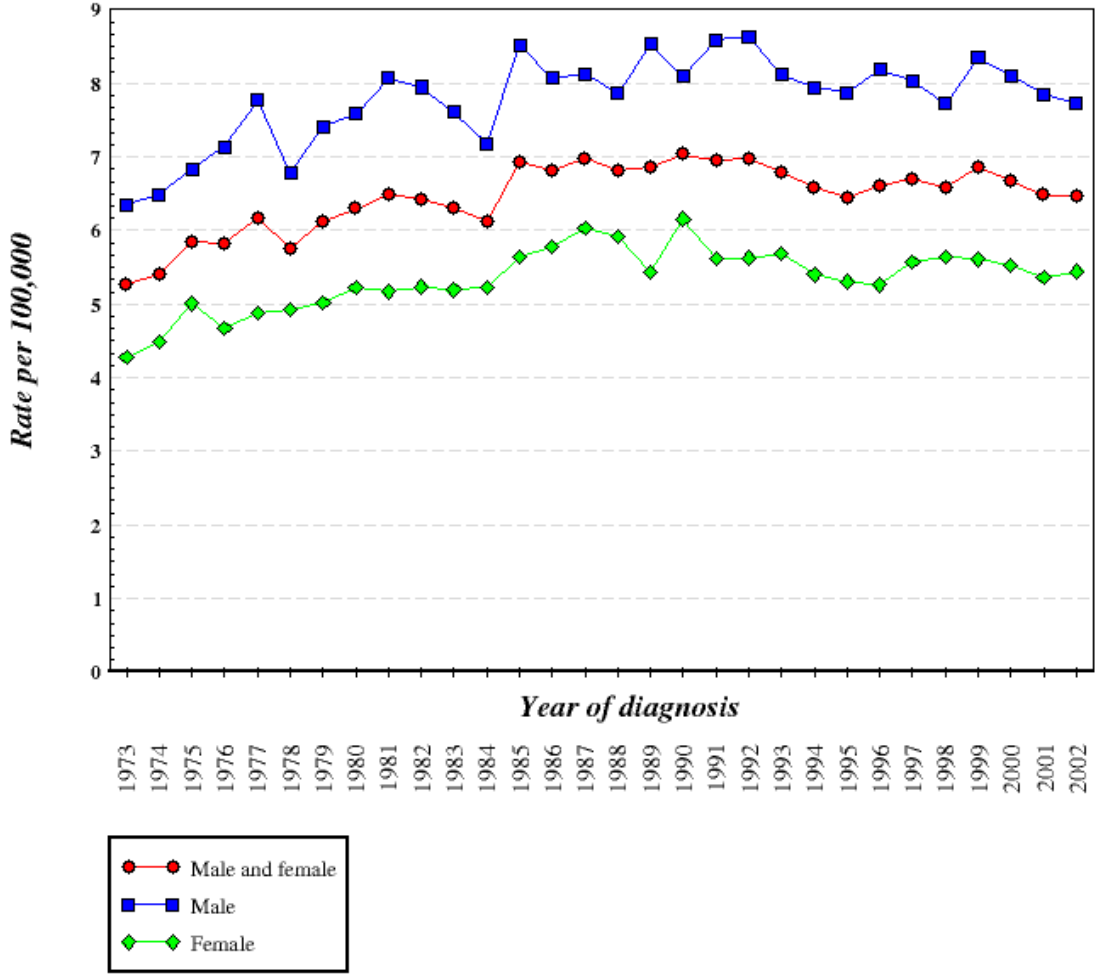
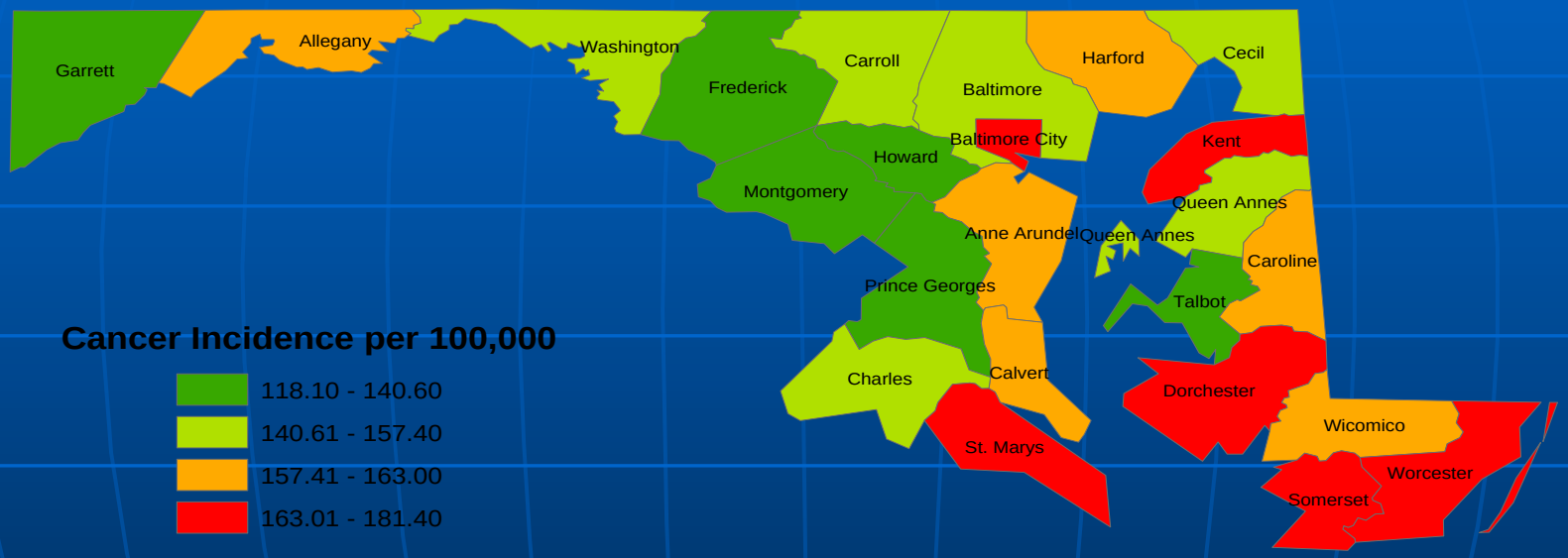
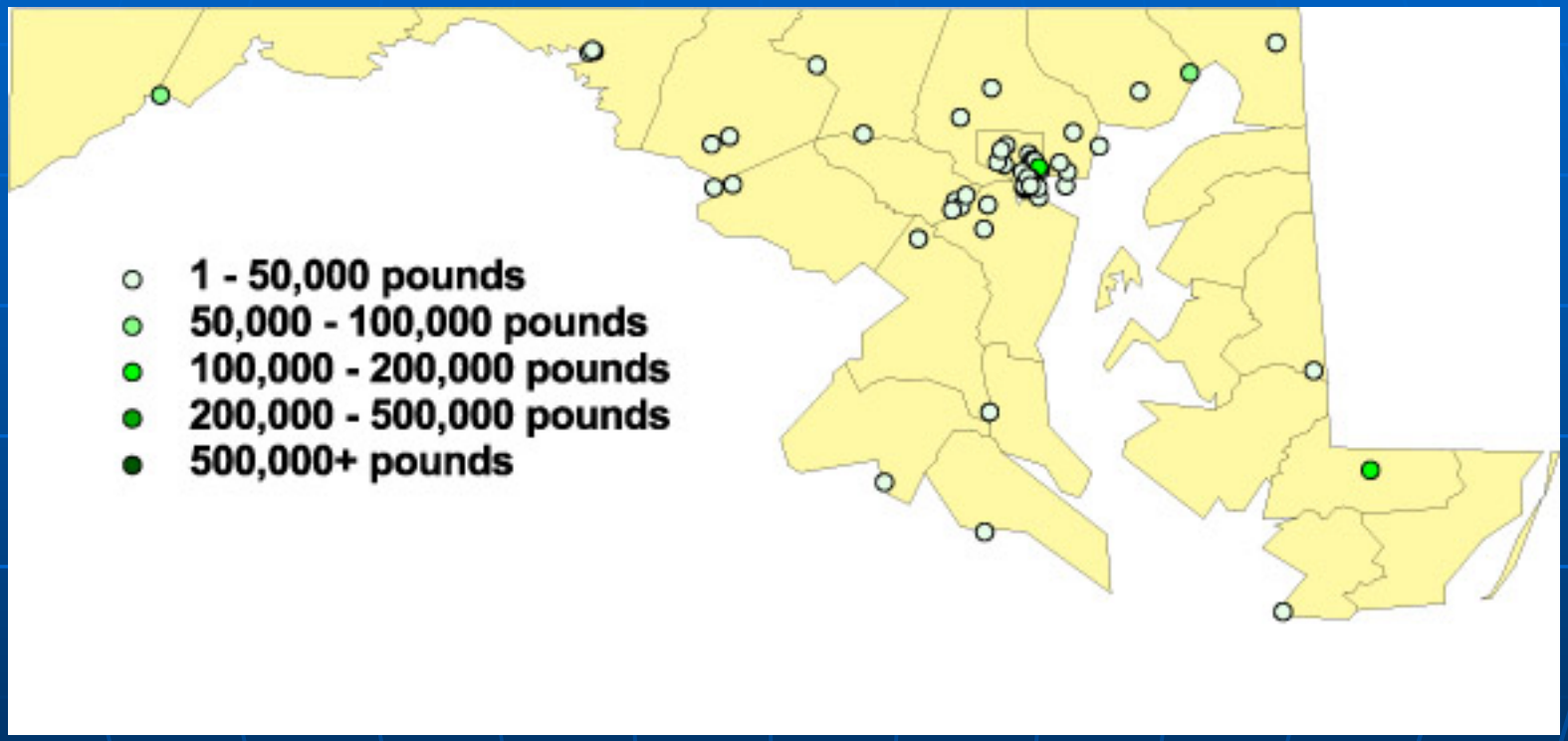


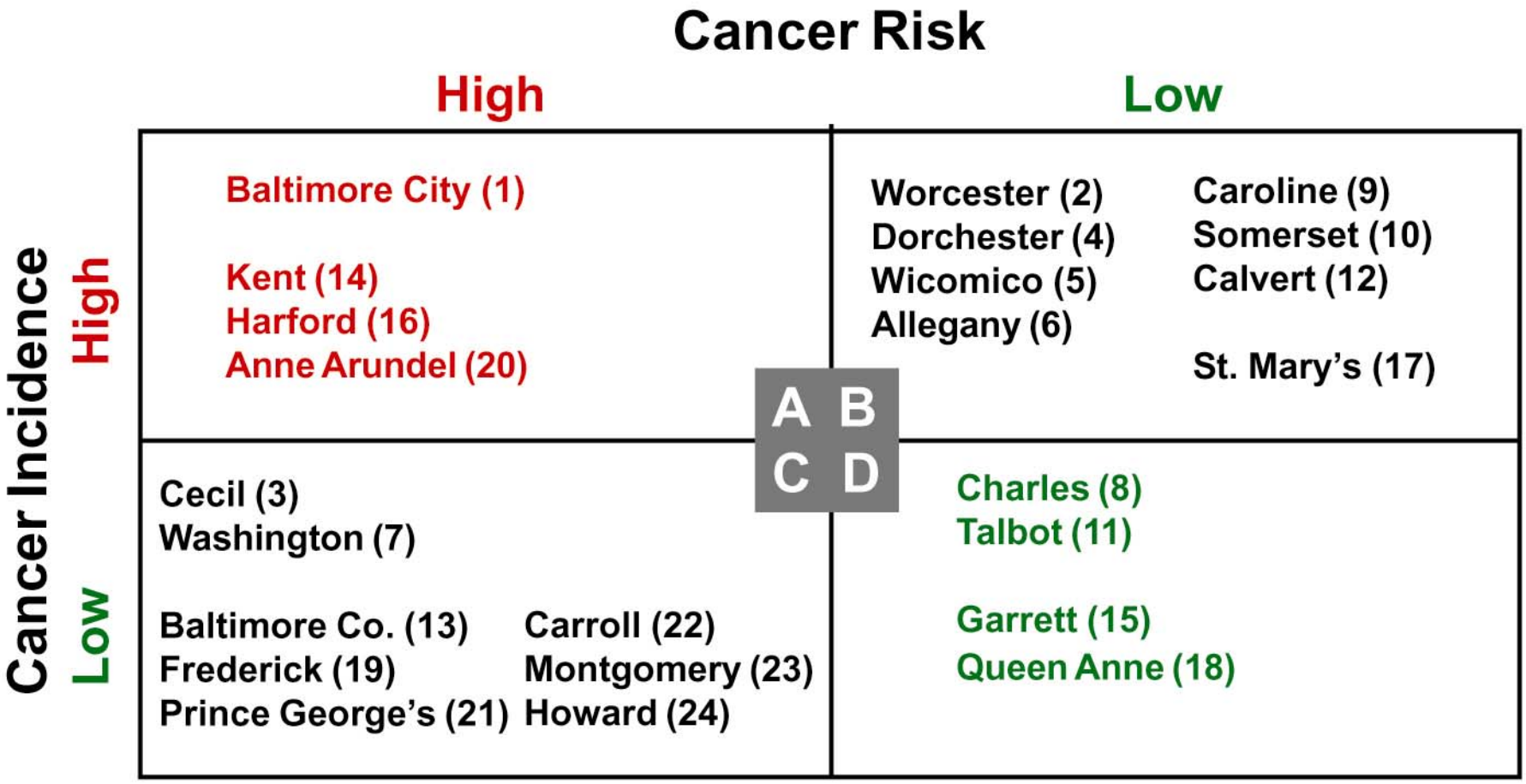
Figure 5. Cancer Incidence Rates for 7 Sites (Bladder, Kidney, Leukemia, Liver, Lung, Multiple Melanoma, NonHodgkin's Lymphoma), Maryland, 1992-1999



-
-

Maryland Carcinogen Releases





Distribution of Maryland counties by cancer risk (tier 1 carcinogens) and incidence (seven environmental cancers) sorted by values above (high) and below (low) the median. Numbers in parentheses are county ranks for adult smoking prevalence for the year 2002 (MD DHMH 2003).

Baltimore Chromium Cleanup

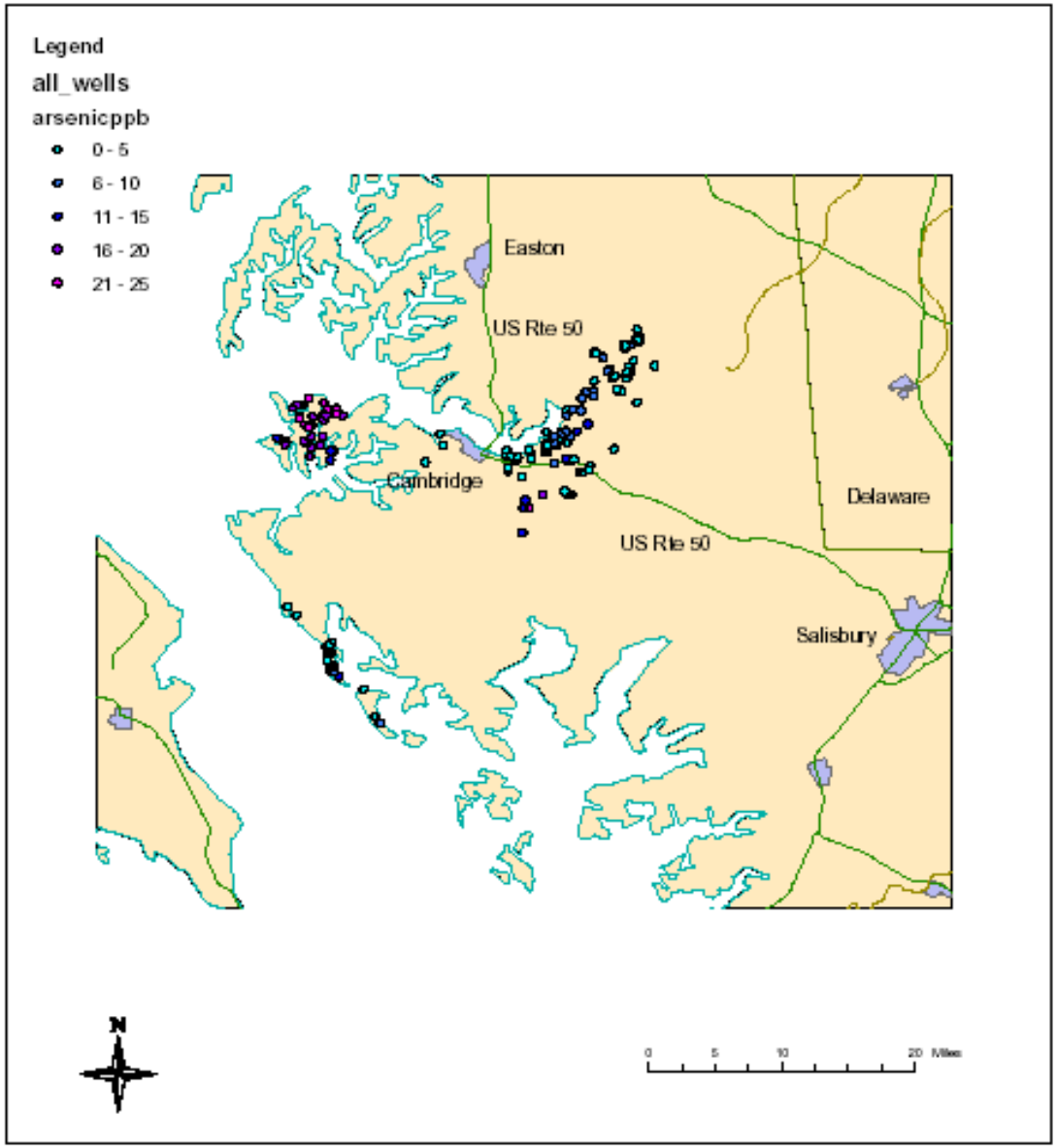
Arsenic in Eastern Maryland Ground Water

Tracking data + spatial analysis tools

↓

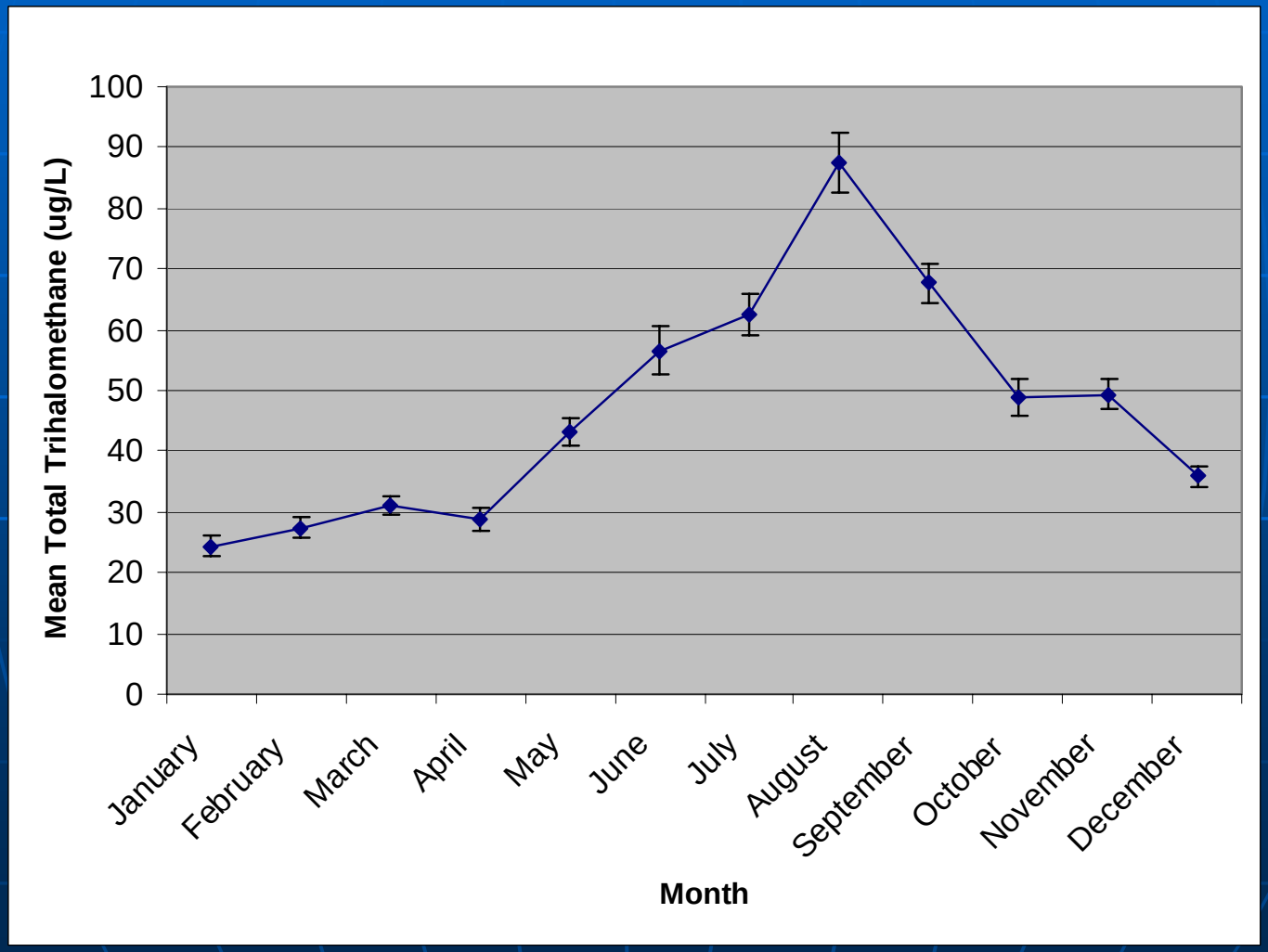
Insights into the role of environmental exposures on human health

Dorchester County (all wells)



Note: Map is based on data for 224 wells

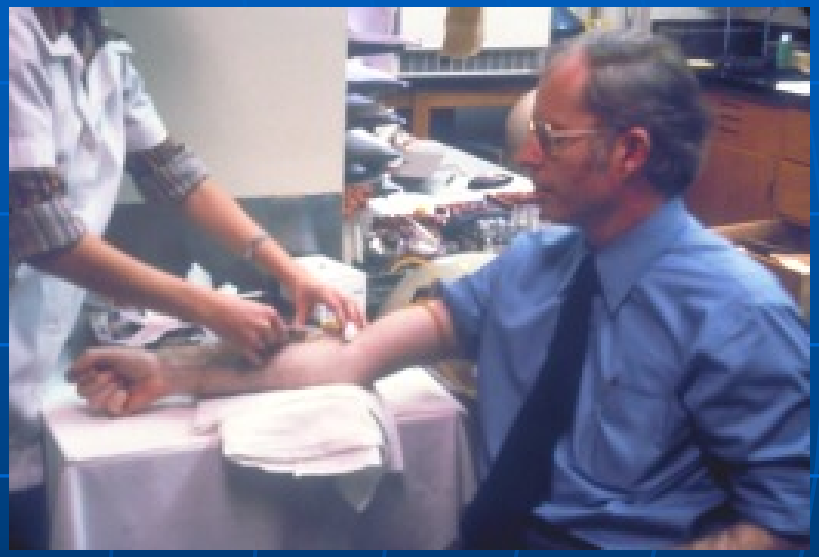
Maryland Mean TTHM Concentrations



Biomonitoring

What is it?

Measurement of chemicals or their metabolites in human specimens including blood, urine, hair, nails, cord blood, milk.



"This is a giant step forward to understanding the relationship between exposure to chemicals and their potential health effects"

Dr. Julie Gerberding, CDC's director

Uses of Biomonitoring

- Measure amount of chemical absorbed into the body
- Provide a measure of individual or population exposure levels
- Evaluate health effects
- Identify those at highest risk
- Track trends
- Guide prevention strategies

Future Directions

- Improved Surveillance (Tracking)
  - Hazards and sources
  - Exposures
  - Biomonitoring
  - Health outcomes

Future Directions

- Improved information to inform public and policy makers

- Refined Epidemiological Studies
  - High risk populations
  - Clusters
  - Infection/environment interaction
  - Social/environmental interaction

Conclusions

- Environmental cancer risks are real
- Understanding and reducing these risks is an essential component of cancer prevention
- There has been great progress, but many challenges remain

Getting to Prevention