The National Academies

Building the 21st Century: U.S. – China Cooperation on Science Technology and Innovation

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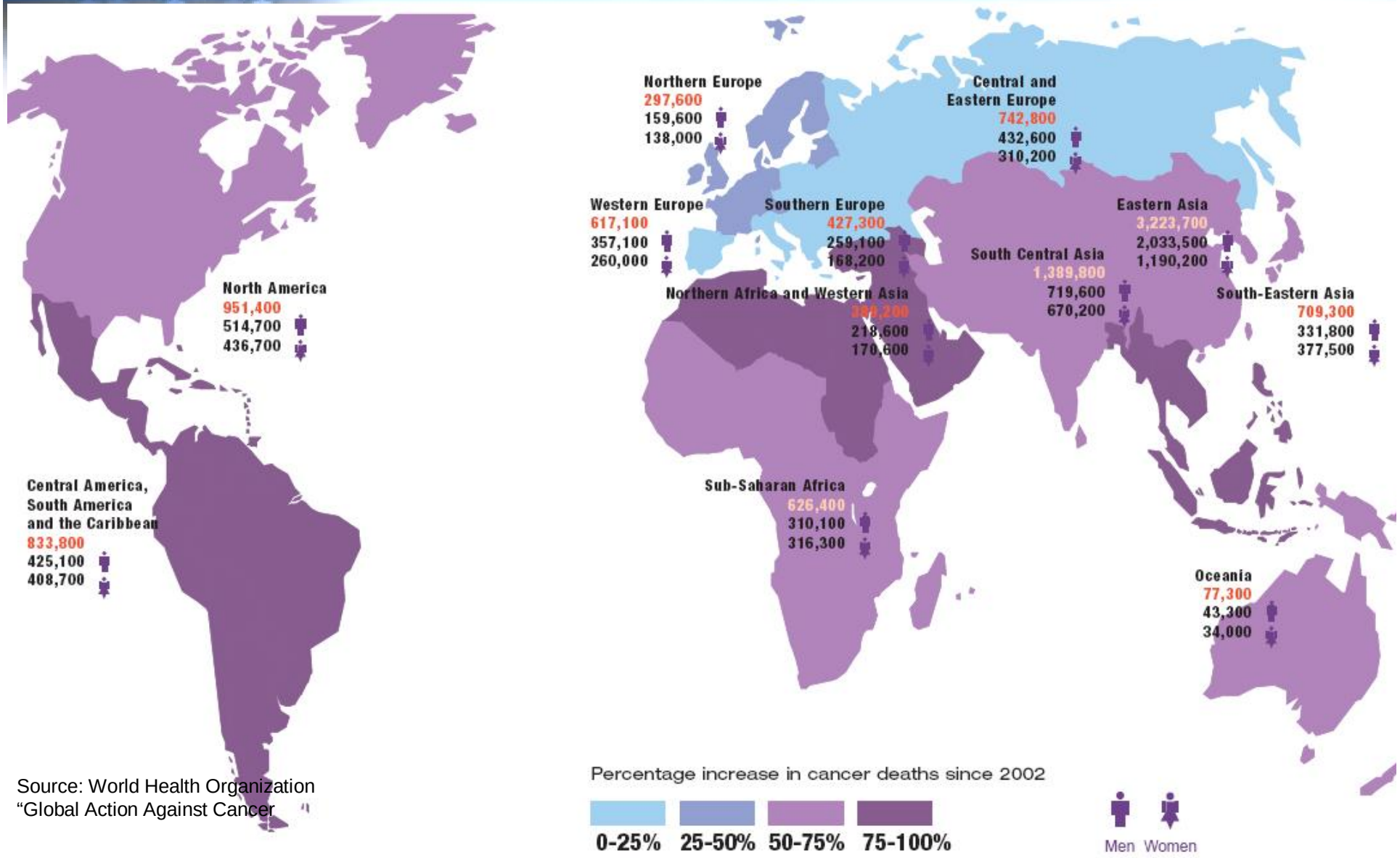
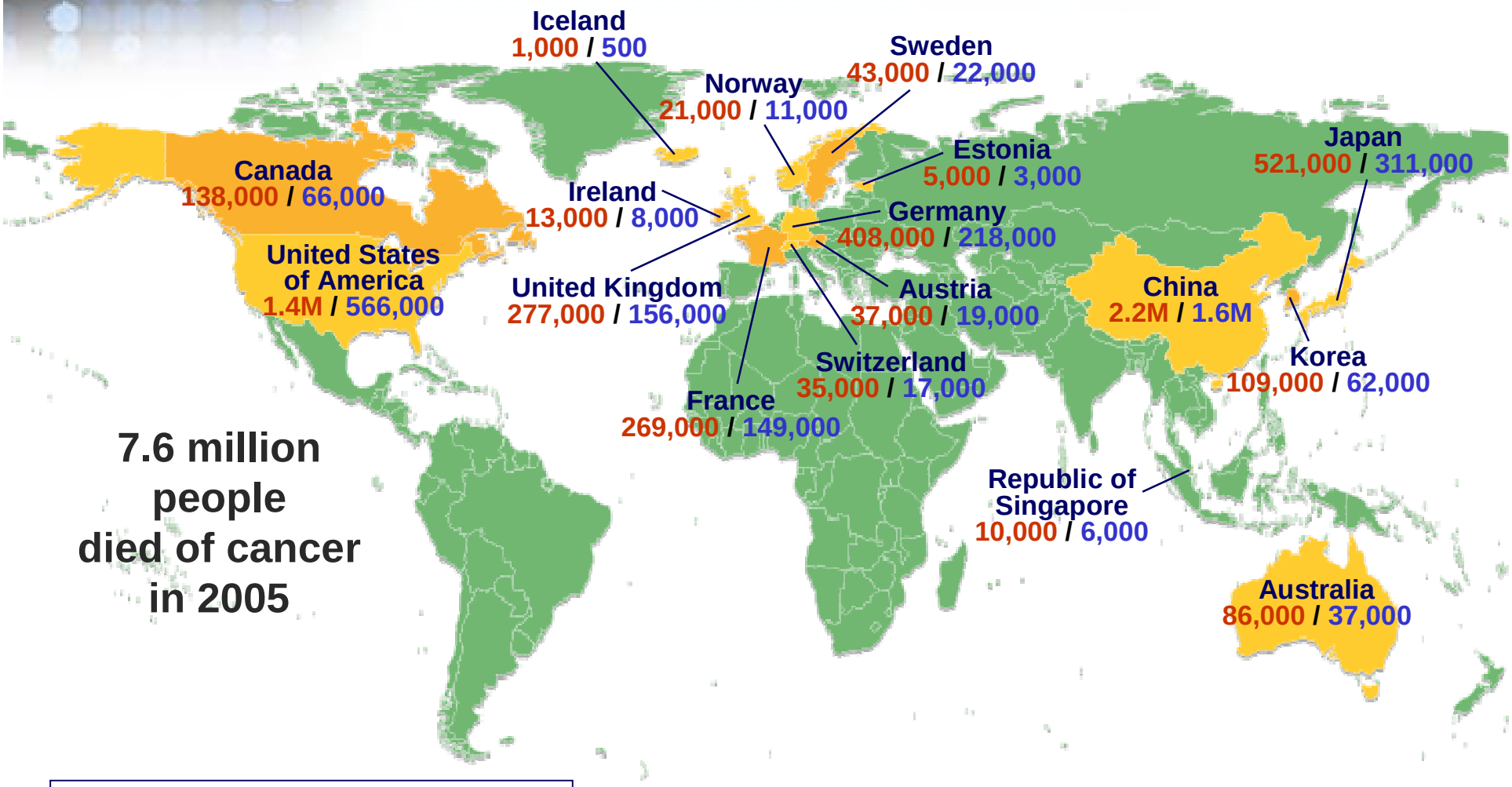
By 2020, Cancer Could Kill 10.3 Million People per Year (16 million new cases per year)



Source: World Health Organization
"Global Action Against Cancer

An International Imperative: Address the Growing Cancer Burden

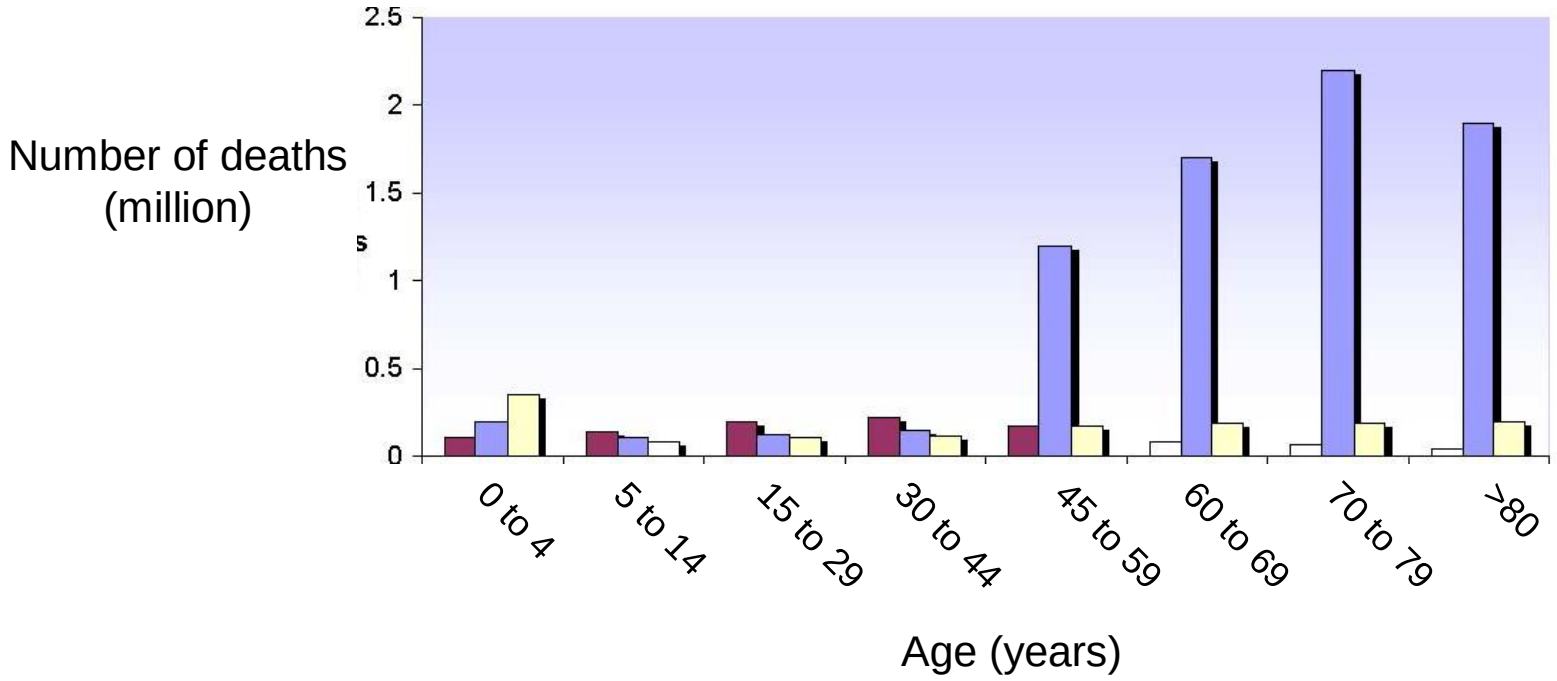


Cancer Incidence / Mortality per year

Source: Derived from International Agency for Research on Cancer, GLOBOCAN 2002 database

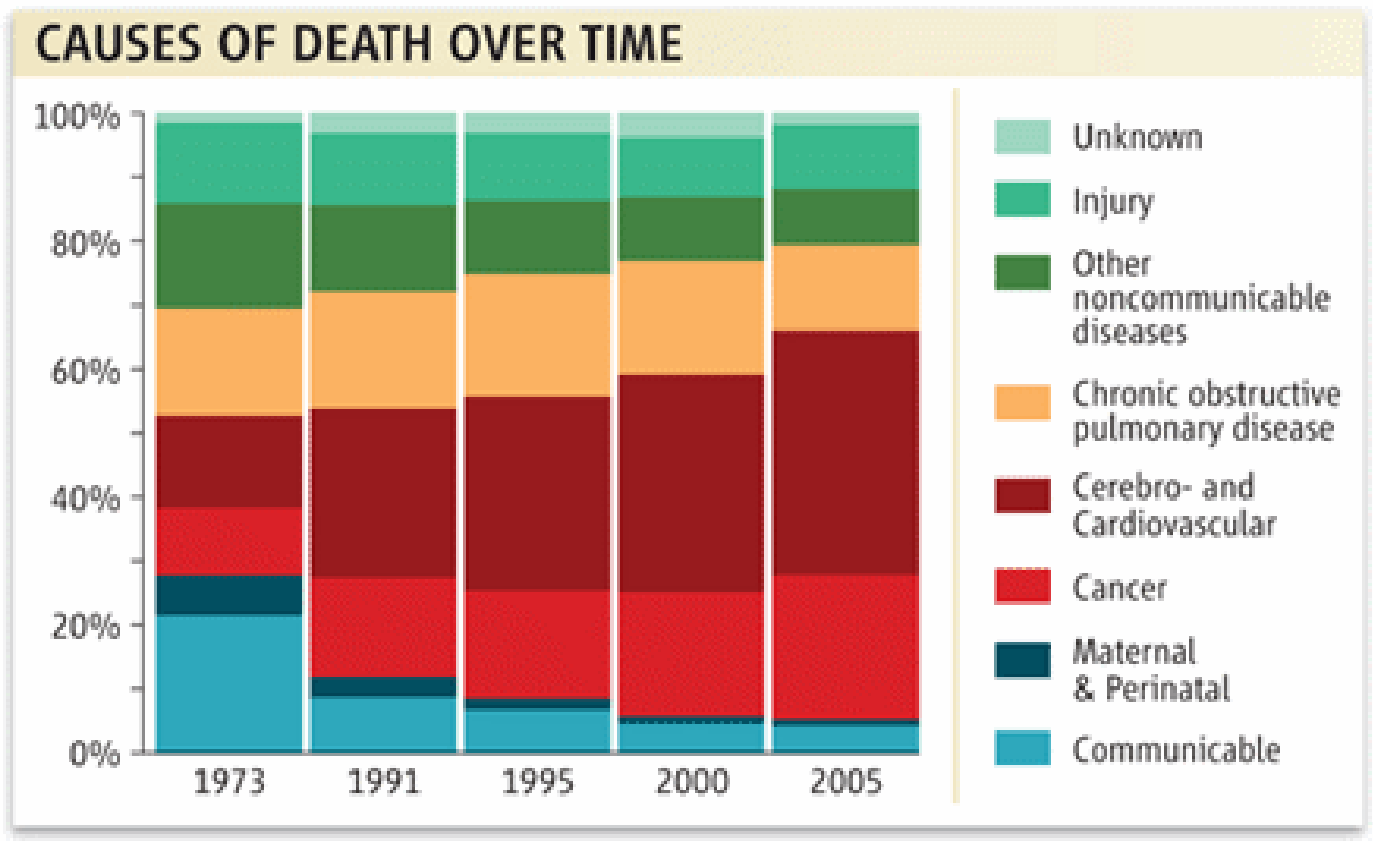
Disease in China: Acute and Chronic Diseases

Number of Deaths in China by Cause and Age in 2003



Source: WHO World Health Report (2005)

Causes of Death Over Time in China

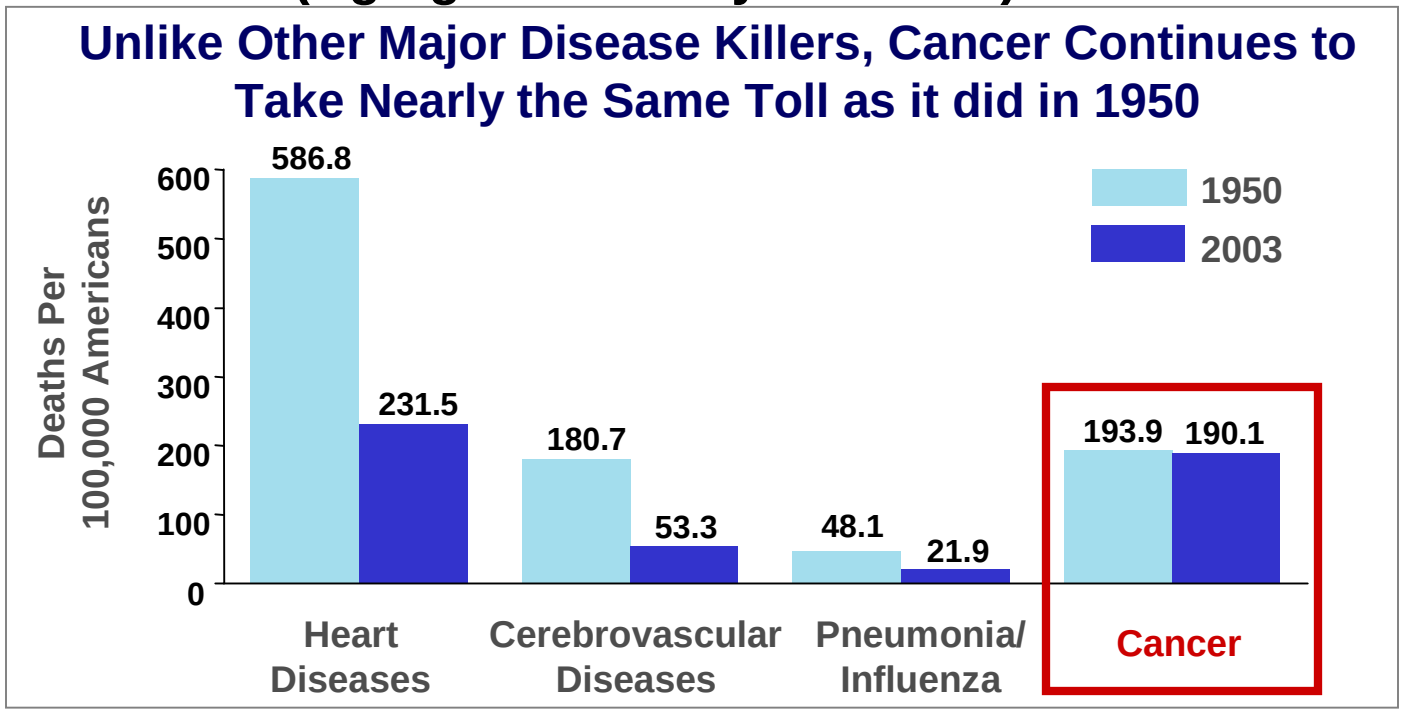


D. Normile Science 328, 422-424 (2010)

Published by AAAS

Impact of Cancer in the U.S.

- ~ 560,000 Americans will die of cancer this year
- ~ 1.4 million Americans will be diagnosed with cancer this year
- ~ $213 billion in 2005 for cancer healthcare costs
- Numbers of new cancer cases will increase by 30-50% as we approach 2020 (Aging of the baby boomers)



Source for 2006 deaths and diagnoses: American Cancer Society (ACS) 2006 Cancer Facts & Figures; Atlanta, Georgia
Source for 2003 age-adjusted death rate: National Center for Health Statistics, U.S. Department of Health and Human Services, NCHS Public-use file for 2003 deaths.

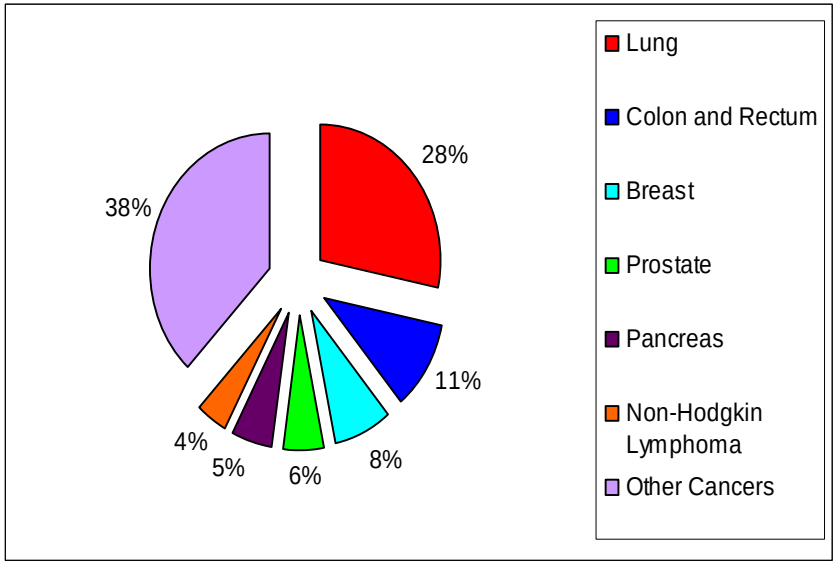
Cancer in China

- 2008 national mortality survey estimates that cancer is #1 killer in Chinese cities and #2 killer in countryside
  - Accounts for 25% urban deaths, 21% rural deaths
- Contributing factors include:[1]
  - Aging population
    - 23% of Chinese population will be >60 years by 2035
  - Dietary changes
    - 23% population is overweight
  - Environmental/occupational hazards
  - Hepatitis B
  - Smoking
    - 350 million Chinese smoke

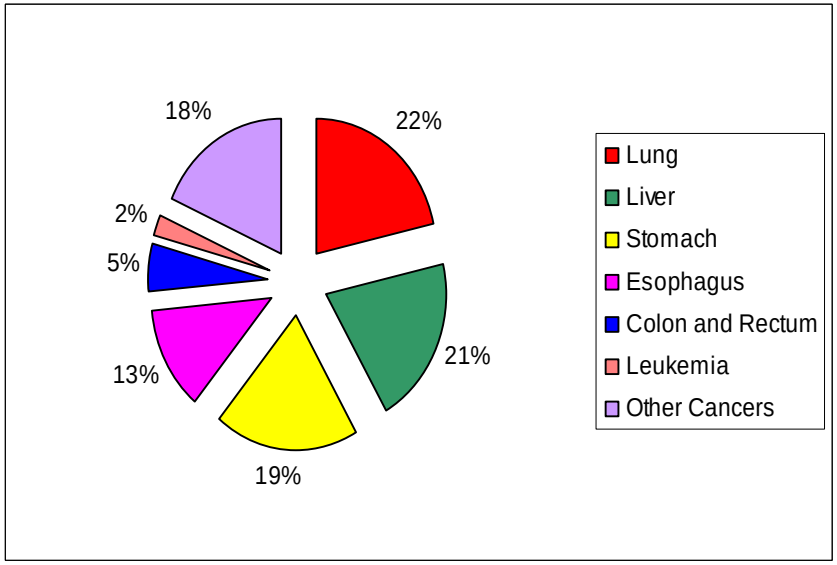
[1]WHO Country Health Information Profiles (2008).

Cancer Deaths in the U.S. and China

U.S.



China



Source: GLOBOCAN 2002 combined data for males and females.

Atlas of Cancer Mortality in China

- In the 1970's China completed a 3-year mortality retrospective investigation of 850,000,000 individuals
- In 1976 an Atlas of Cancer Mortality was published that identified several cancer "hot spots"

1979: A Key Year in the History of NCI-China Cooperation – 30 Years of Collaboration

June

U.S. and Chinese Governments sign the Health Protocol

September

Annex 1 of Health Protocol specifies areas of cancer research for increased cooperation

November

NCI Director, Arthur Upton, meets with Chinese Academy of Medical Sciences (CAMS) Cancer Center Director in Beijing-Established Memorandum of Understanding for Cancer Research - Celebrated 30th Anniversary in 2009

Examples of NCI-Supported Critical China Studies (1970's - 80's)

Study:	***Partners:***
§ Benzene	§ DCEG-China CDC
§ Esophageal cancer	§ DCEG-CAMS Cancer Institute
§ Liver cancer	§ CCR- CAMS Cancer Institute, Qidong Liver Cancer Institute
§ Lung cancer – Xuan Wei (indoor cooking)	§ DCEG-China CDC
§ Cancer in textile workers	§ University of Washington-Shanghai Textile Industry Bureau

State of Biomedical and Complementary Research Areas in China

- In the past decade, the number of scientific papers published by Chinese scientists quadrupled
  - In 2007, the total number of publications by Chinese scientists was second only to that of the United States[1]
- The largest share of publications by Chinese scientists are in the fields of materials science, chemistry, physics, mathematics[2]
- The number of life sciences publications by Chinese scientists has expanded substantially in the last decade[2]
- Number of collaborations between U.S. and Chinese scientists doubled between the periods of 1998-2003 and 2004-2008[2]

[1] *New York Times*, January 6, 2010

[2] *Global Research Report China* (2009), Thomson Reuters

Major Organizations in China Involved in Cancer Research - Collaborators

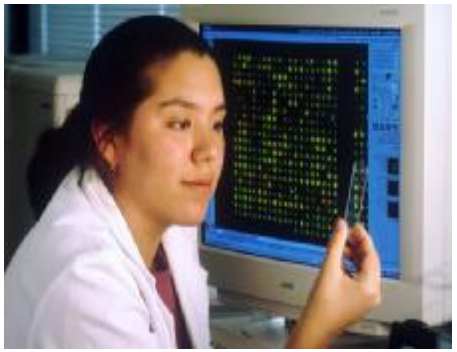
- Chinese Academy of Medical Sciences
  - Cancer Institute/Hospital recently designated as China's National Cancer Center
- Chinese Academy of Sciences
  - Approximately 20 out of 90 CAS Institutes focus on biological research
- China CDC
  - Focuses on disease control and prevention
  - Cooperates with hundreds of provincial, city and county CDCs throughout China as well as township health centers and clinics
- Universities
  - Leading cancer research universities include: Fudan University, Tianjin Medical University Cancer Institute and Hospital, Peking University, and Zhongshan University

NIH/NCI-China Research Partnership Areas of Focus – Innovative Approaches

- Cancer Genomics
- Nanotechnology and Cancer
- Environmental Pollution and Cancer
- Cancer Treatment Clinical Trials
- Emerging Areas

Cancer Genomics

- Opportunity to study rare cancers and to investigate genetic differences between different geographical populations that may affect cancer risk, progression, outcome and/or drug response
- Access large populations of patients with common cancers in China (e.g. esophageal, gastric, liver)
- Investigate genetic differences in Chinese populations that may affect drug response
- Build on existing expertise in cancer research and genomics in China
  - Completed 1% of Human Genome Sequence
  - Launched Chinese Cancer Genome Project



Selected Achievements in Genomics in China

- Joined France, Germany, Japan, UK and the USA to sequence the human genome
  - China was the only developing country to participate in this effort
- Completed rice genome sequence before international rice genome consortium led by Japan
- Chinese scientists were among the early groups to identify SARS coronavirus
- In 2010, Beijing Genomics Institute becomes world's largest next generation sequencing center[1] ---NCI and BGI currently working on collaborative genomics program in brain tumors

[1]*Nature Biotechnology* (2010) **28(3)**:189-191

Nanotechnology and Cancer

- Potential to advance research progress in several areas, including: use of nanomaterials for oncology applications, pre-clinical research, and safety and standardization of nanomaterials
- China is estimated to have more than 5000 scientists at 50 universities, 20 CAS institutes, and more than 300 enterprises in nanotechnology[1]
- Build partnerships based on strengths
  - Chinese Central Government invested an estimated $240 M USD from 2004-2007, and local governments another $360 M USD[1]
  - China has the second largest world share of publications in nanotechnology after the U.S.
- Building upon interest of top Chinese organizations
  - Organized first Joint U.S.-China Symposium on Nanobiology and Nanomedicine with the National Center for Nanoscience and Technology of China (NCNST), CAS

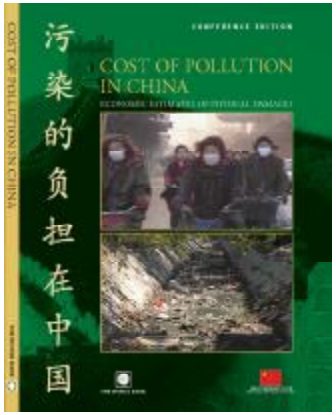
[1]*Science* (2005) **309:** 65-66.

[2]*Scientometrics* (2007) **70(3):** 693-713.

NCNST: www.nanoctr.cn

Environmental Pollution and Cancer

- Study levels and types of environmental exposures not observed in the U.S.
- Build on strong history of NCI epidemiology and occupational health studies
- Build upon interest of top Chinese research organizations to develop new partnerships in this area
  - Environmental pollutants and cancer meeting co-organized with CAS, FIC and NIEHS
- Leverage partnership opportunities with U.S. CDC, State Department experts, and International NGOs in Beijing



World Bank/SEPA Report 2007

Cancer Treatment Clinical Trials

- Potential to accelerate patient enrollment for cancer clinical trials
- Study cancers that are more common in China than the U.S.
- Build on international activities of the NCI Clinical Trial Cooperative Groups, Cancer Centers, and SPOREs
- Build on China central and local government support for globalizing clinical research in China
  - Examples include: Shanghai Clinical Research Center, China Medical City, Taizhou
- Assist in the development of China's clinical trial infrastructure
  - Data quality control,
  - Human subjects regulations,
  - Informatics systems

Expanding Healthcare Partnerships in China

- Growing burden of chronic disease in China and U.S.
- Both U.S. and China making major investment in science and technology (China's investment nearly tripled between 2000 and 2005[1] to an estimated 1.1% of GDP,[2] and continues to increase
- Opportunities to partner for mutual benefit during the development of China's cancer research capabilities during growth phase (long history of working together)
- Large numbers of U.S.- trained scientists are returning to leadership positions in China's biomedical research sector[3]

[1]*Science* (2007) **318:** 586-587.

[2]*Science* (2005) **309:** 65-66.

[3]*Washington Post,* February 20, 2008.

NCI's Office of China Cancer Research Programs

- Building on past scientific alliances, Chinese alumni (nearly every cancer institution in China is led by someone trained at NCI), scientific opportunities and advantages of having a presence in-country in 2007, as part of a broader global strategy, the NCI:
- Posted Dr. Julie Schneider to Beijing in 2008
- Offices in China: HHS - NIH/NIAID - U.S. Centers for Disease Control - Food and Drug Administration - NCI

Healthcare – Personalized Medicine: Ten Year Outlook

- Leadership in science and medicine – distributed – and driven by talent base – ability to access and leverage information and investment
- Medicine: shift toward understanding disease mechanisms – diagnosing earlier – down staging; moving toward global standards
- Health care system changes – knowledge base combined with new bioinformatics tools and broadband will enable access to unprecedented information, tools and strategies – conceivably anywhere on the globe
- Healthy populations will become critical – and define stability and economic capability
- Economics – rapid rise of knowledge based economies – shift of economic strength