역학이란 무엇인가 ?
: 발전배경, 정의, 그리고 연구영역

김 동 현

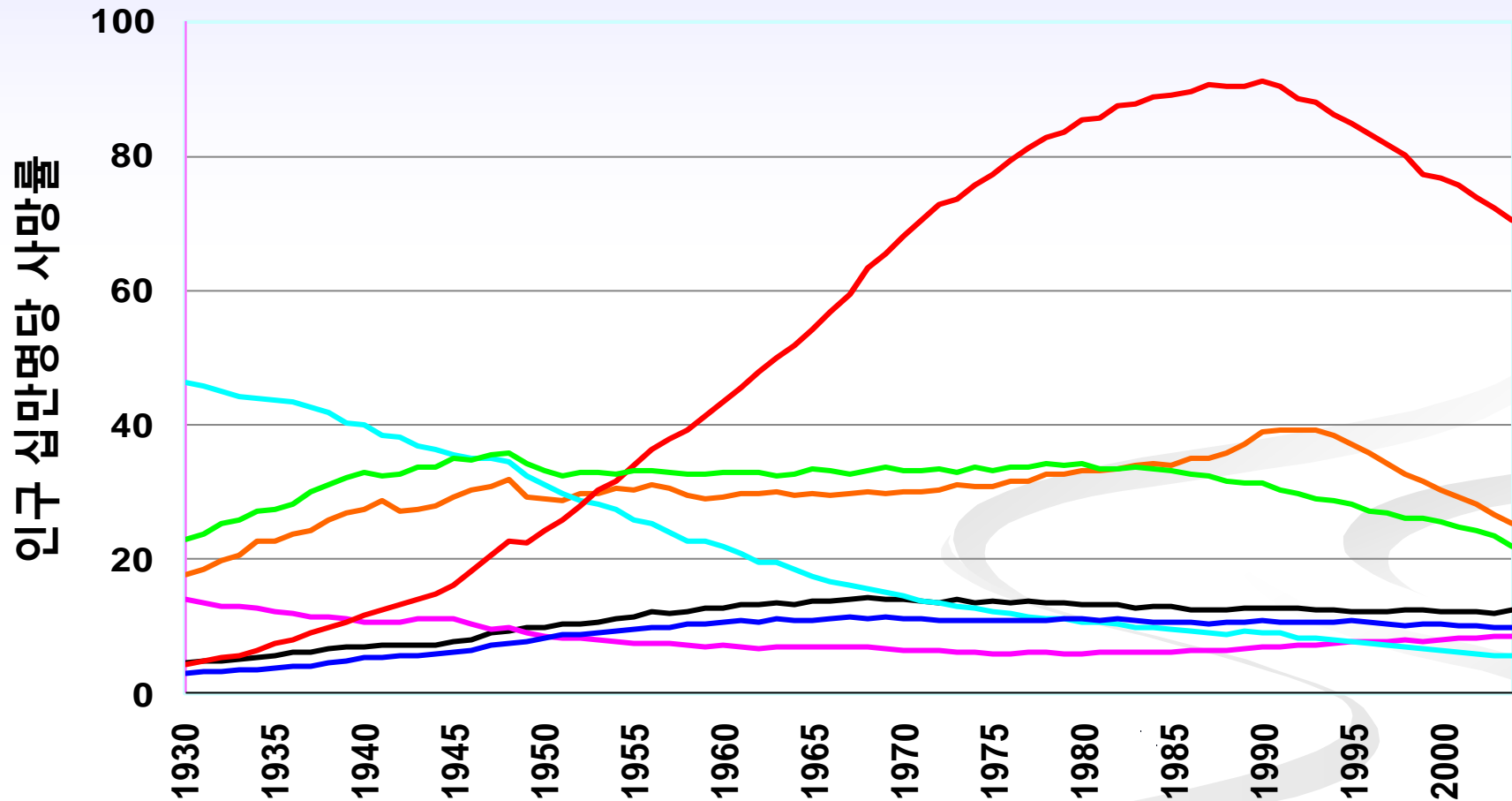한림대학교 의과대학

학 습 목 표

1. 역학의 정의를 이해한다.
2. 역학연구 발전에 기여한 역사적 사례를 학습한다.
3. 역학연구의 활용영역을 이해한다.
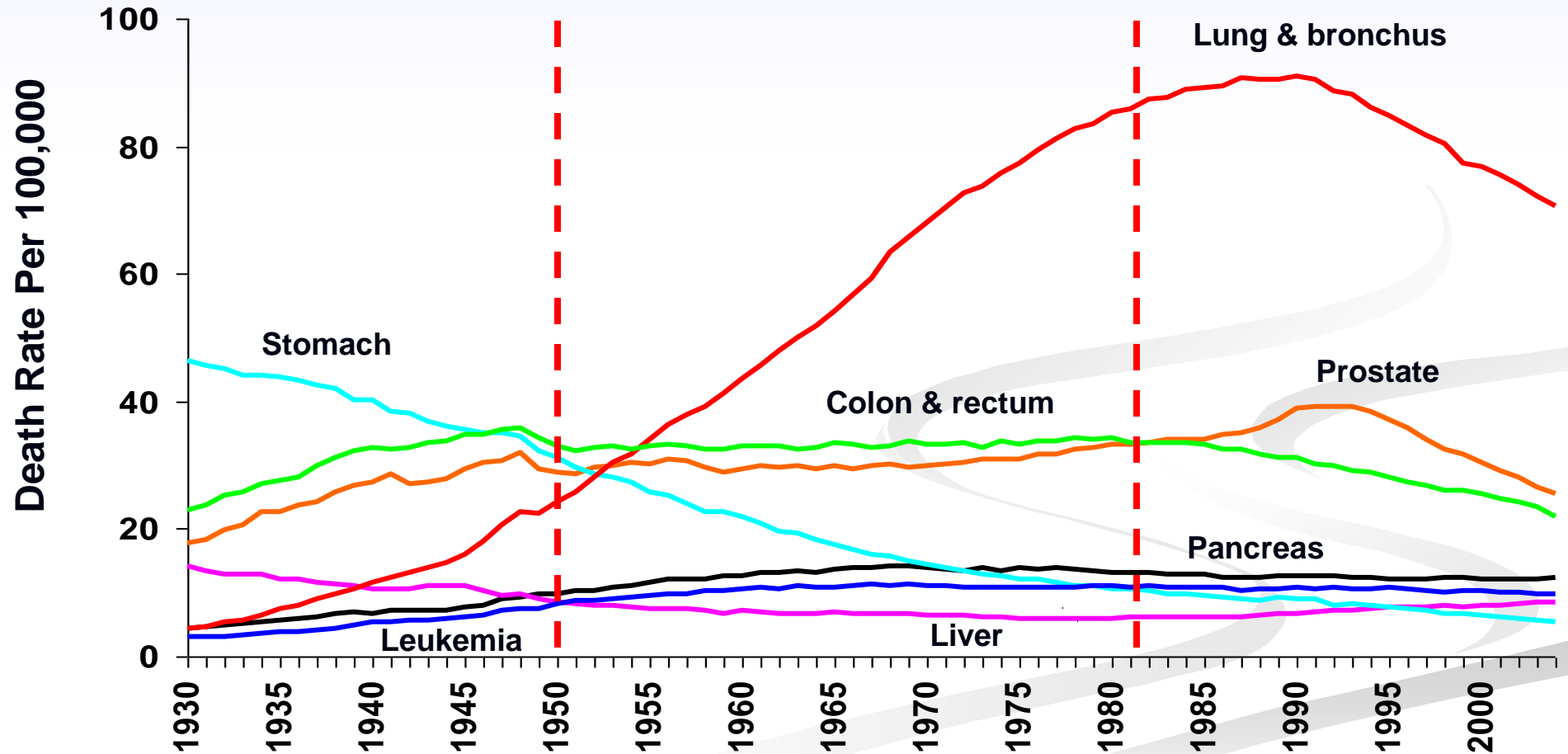**4.** 역학연구의 발전방향을 토론한다.

참고문헌

1. Lilienfeld DE. Definition of Epidemiology. Am J Epidemiol 1978;107:87-90
2. Rose G. Sick individuals and sick populations. Int J Epidemiol 1985;14:32-38

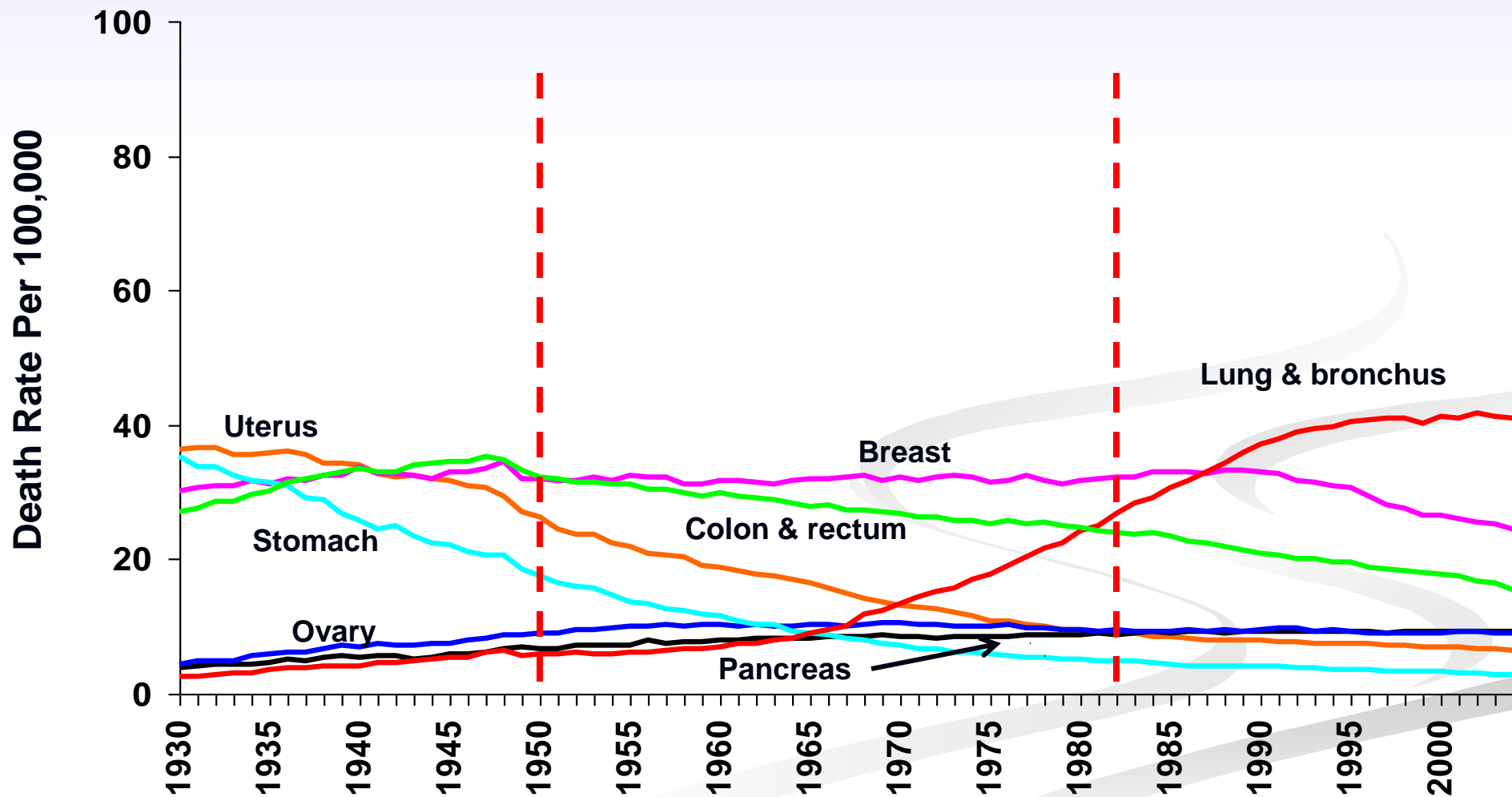# 미국 백인 남성의 암 사망률 장기변동, 1930-2004년

*Age-adjusted to 2000 US standard population (Source: US Mortality Public Use Data Tapes 1960-2004,NCHS, 2006).

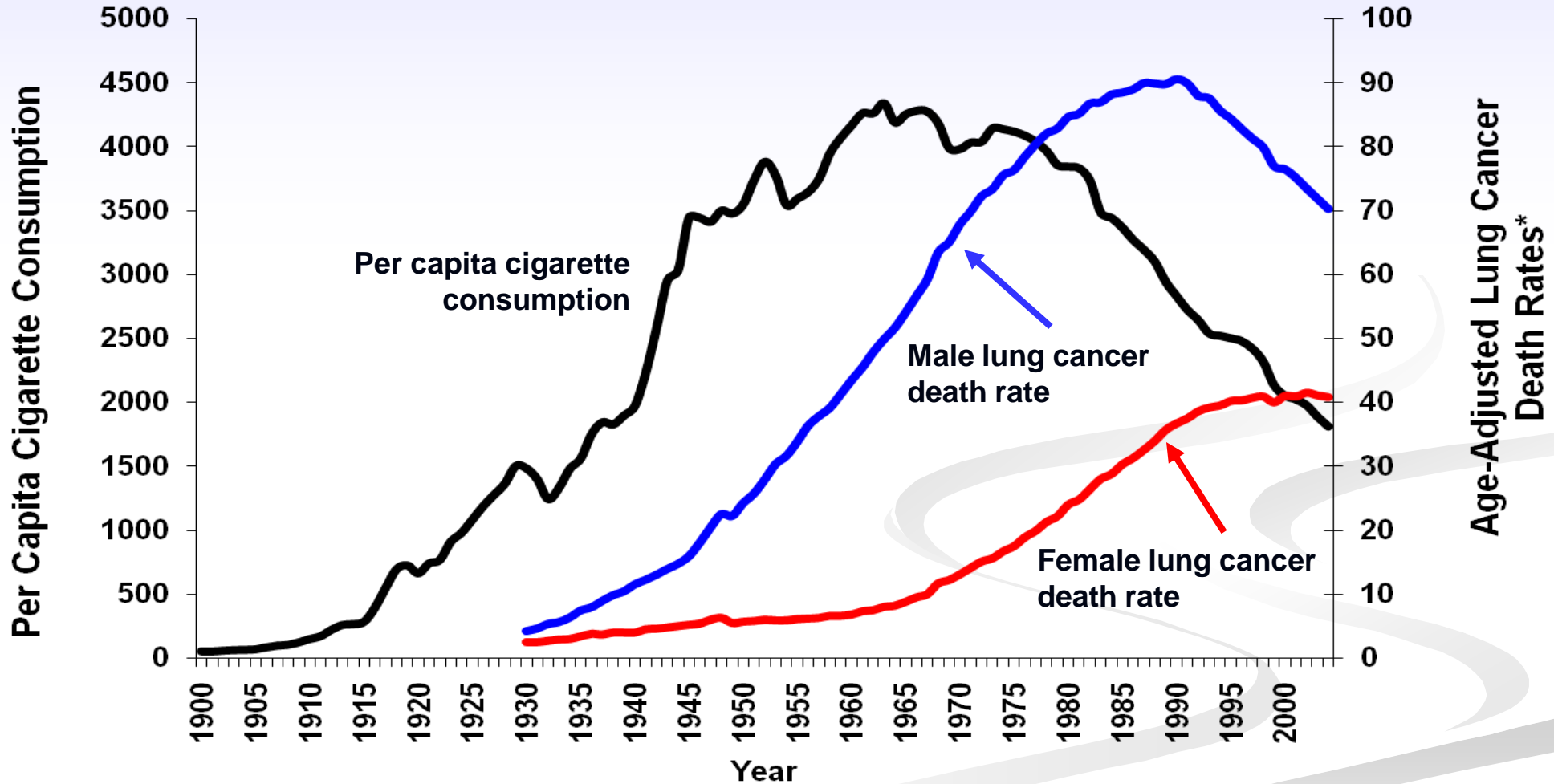# Cancer Death Rates* in US Men 1930–2004

*Age-adjusted to 2000 US standard population (Source: US Mortality Public Use Data Tapes 1960-2004,NCHS, 2006).

Cancer Death Rates* in US Women 1930–2004

*Age-adjusted to 2000 US standard population (Source: US Mortality Public Use Data Tapes 1960-2004, NCHS, 2006).

US Tobacco Use vs. Lung Cancer Deaths, 1900–2004

*Age-adjusted to 2000 US standard population.
US Mortality Data, 1960-2004, US Mortality Volumes, 1930-1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 2006. Cigarette consumption: US Department of Agriculture, 1900-2004.

Source: Death rates:

역학의 정의

- 인구집단에서 특정 건강관련 현상(문제)의 분포를 기술하고, 그 결정요인이 무엇인지를 밝혀냄으로서, 궁극적으로는 해당 건강문제의 해결에 기여하고자 하는 학문 (Last JM, 2001)

- 기술역학과 분석역학

역학연구의 발전배경 – 환경병인론

- 히포크라테스 Hippocrates – 'On Airs, Waters, Places'

- 점액설 'Miasma theory' (early 18c)
    - Foul emanation from soil, air, and water
- 병원균설 Advent of 'Germ Theory' (late 18c)
    - Henle - Infection by minute organism (1840)
    - Advances in microbiology – Koch, Pasteur
    - "bacteriologic era" in the United States

역학의 발전배경 – 계량적 지식의 발전

- John Graunt – Bills of Mortality (1603-1658)

- William Farr – Vital statistics (1839)

→ 생명현상도 계량적으로 정리하면 일정한 규칙성이나 일반성을 파악할 수 있다.

역학의 발전배경 – 귀납적 관찰연구

- James Lind – Lime juice in Scurvy (1747)

- John Snow – Cholera in London (1854)

- Semmelweiss – 산모사망, 비교실험적 접근 (~1840)

- Goldberger – Nicotine deficiency in Pellagra

→ 건강-질병 현상에 관여하는 요인을 귀납적 관찰과 비교 실험을 통해 규명해 낼 수 있다.

역학연구의 발전 (1)

- 만성질병시대의 도래 **(20 세기 중반)**
  - 평균수명의 연장
    - 위생 및 영양상태 호전, 감염병 질환 감소
  - 여러가지 복합적 요인에 의한 만성질병시대
- **Framingham Heart Study (1949 – 현재)**
  - 심장병에 대한 위험요인 연구
- **British doctors' cohort**
  - **Doll and Hill (1954)**
  - **Smoking and lung cancer**
- **Salk vaccine field trial (1954)**
  - 사람 대상 실험으로는 가장 대규모 개입연구 – 소아마비

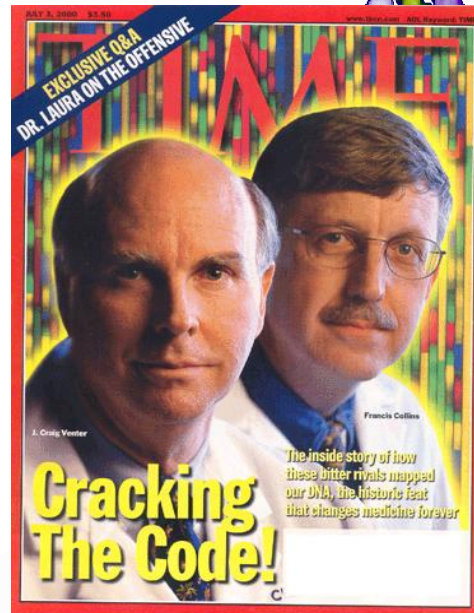# 역학연구의 발전 (2)

- 서구사회의 역학적 연구의 발전 (1960년대 이후)

  - 1959 – Mantel and Haenszel

  - 주요한 발견

    - Smoking and lung cancer – Surgeon General (1964, US)

    - Asbestos exposure and lung cancer

    - DES and vaginal cancer

    - HIV and AIDS

    - Dietary practice and health – folate and neural tube defect

"Breakthrough of the Year"

- "For 2000, one word sums it up- GENOMES"

    Science (2000)

Evolving epidemiolgic study ...

Environmental
Exposure
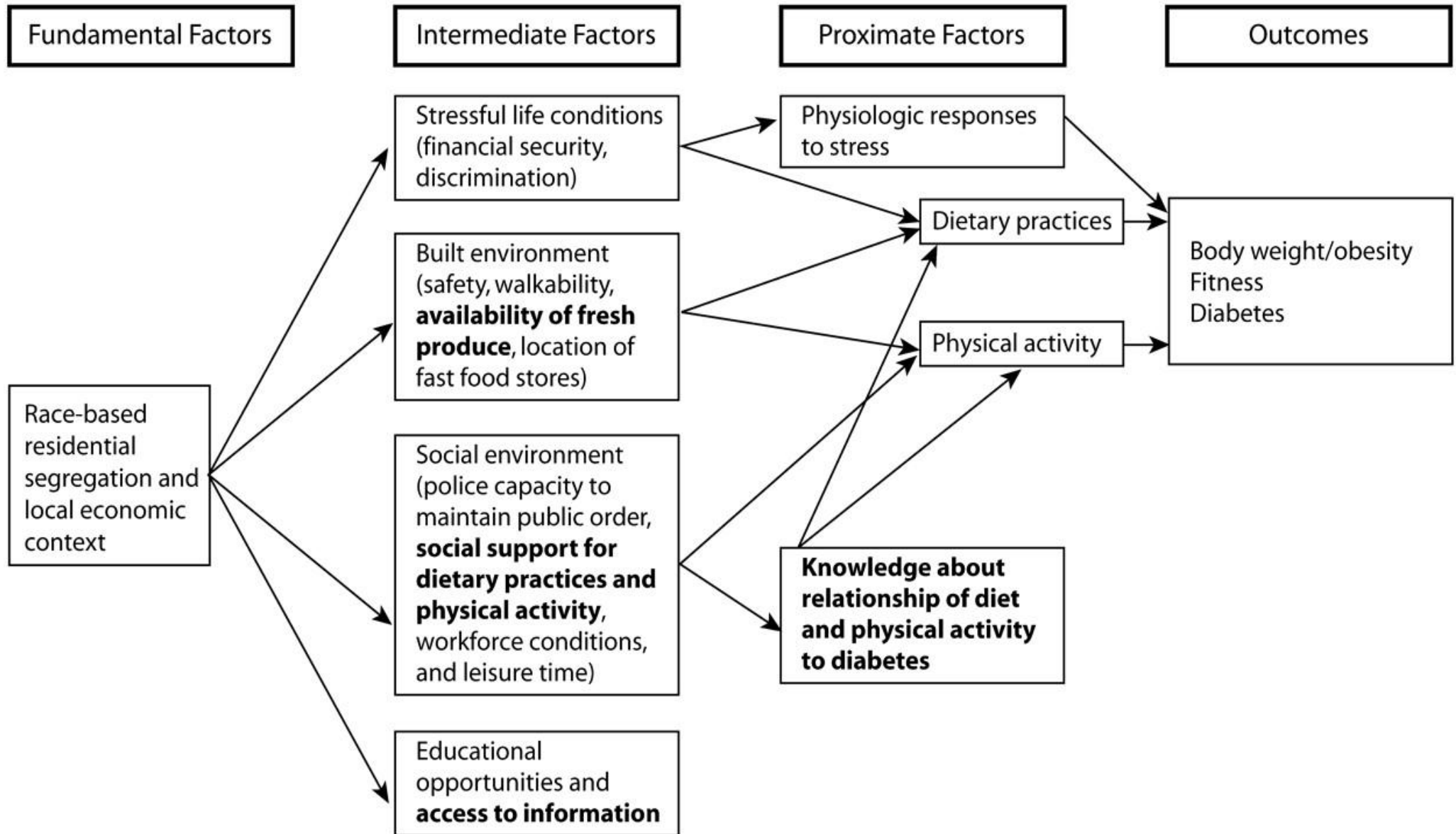(e.g. alcohol/diet) → [black box] → Disease
or
Mortality

?

Who is susceptible ?
What is the mechanism ?
Which biomarker is predictive ?

What makes this box transparent ?

Social Determinants of Obesity
(Schultz AJ, Am J Public Health. 2005)

Fundamental Factors

Race-based residential segregation and local economic context

Intermediate Factors

Stressful life conditions (financial security, discrimination)

Built environment (safety, walkability, **availability of fresh produce**, location of fast food stores)

Social environment (police capacity to maintain public order, **social support for dietary practices and physical activity**, workforce conditions, and leisure time)

Educational opportunities and **access to information**

Proximate Factors

Physiologic responses to stress

Dietary practices

Physical activity

Knowledge about relationship of diet and physical activity to diabetes

Outcomes

Body weight/obesity
Fitness
Diabetes

역학연구의 미래

- 'Epidemiology faces its limits' by Taubes (Science, 1995),
    - Dietary fat and breast cancer, B-carotene and lung cancer
    - Can we tell a little thing from nothing at all ?
    - Are we pushing the edge of what can be done with Epidemiology ?
- Beyond the limit … …
    - looking into black box
    - synthesis of data

- Reductionist approach – causal pathway at the molecular level
            vs
    Expansionist approach – disease problems arising out of the socioenvironmental conditions

Beyond individualism in epidemiologic research

◆ **Success of risk factor epidemiology:** 개인행태 강조하는 보건의료 및 역학연구 풍미 **(particularly, the "big four" of smoking, drinking, diet, and exercise),** measuring associations of exposure and disease in individuals

◆ **Decontextualized individual risk factor and loss of population perspectives in epidemiologic research and public health practice**
 : life style in individuals
     vs historical, cultural, and socioeconomic context in populations
 : tobacco smoking vs (production, advertising, distribution)

◆ Need to develop new study design incorporating **population** in its major component.
 : population with its own history, culture, organization, and economic and social divisions, which influence how and why people are exposed to particular factors.
(Pearce, 1996)

Population Health and Community as a target of intervention

◆ "Population health" defined as health outcome of a group of individuals and their distribution in a population

(Kindig D and Stoddart GL, 2003)

◆ Focusing on the health of entire population, or subpopulation
      vs focusing on improvement in the health of individuals

(Friedman and Starfield, 2003)

◆ Directed at root causes to increase potential benefits for health outcomes

◆ Necessiate the reduction in inequalities in health status between population subgroup

: Gap in the health status according to area → Community intervention

역학연구의 영역 (1)

- Risk factor epidemiology : 발병 관련요인 및 기전

- Epidemiology of clinical medicine : 질병 진행, 치료 효과

  - Prognosis/survival study

  - Clinical trial/drug efficacy study

  - Clinical decision making based on evidence (Evidence-based medicine)

  - Pharmacogenetics

- Genetics and epidemiology : 유전적 영향

  - Variation in DNA sequence among population – Disease susceptibility

  - Gene-environmental interaction

역학연구의 영역 (2)

- Social epidemiology

- Epidemiology and policy : 정책 결정에 기여
  - Primary rationale for research ?
    – advancing knowledge vs advancement of public health
  - Epidemiology as a guide to health policy : evidence-based policy
    - Health effect of passive smoking → reducing smoking in public places
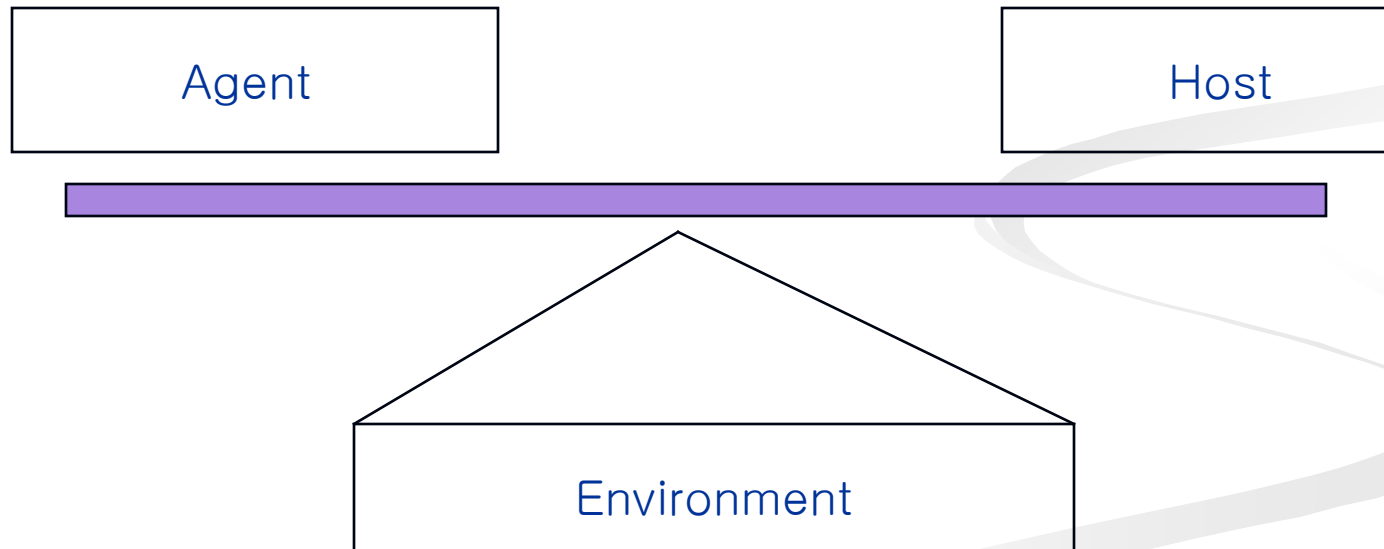   - Air pollution and health

역학연구의 영역 (3)

- Epidemiology for health care evaluation
  - Epidemiology as an information science
    - Effectiveness of screening in improving outcome
- Epidemiology of injuries
  - From descriptive to analytic studies to define the underlying causal pathway
- Epidemiology and ethics

Basic principles of disease prevention

- Primary prevention : Susceptible phase

    - Preventing the onset of disease

    - smoking cessation program

    - Immunization against disease

- Secondary prevention : Preclinical phase

    - Early disease detection and intervention to modify its course and communicability

    - periodic health examination, Screening

- Tertiary Prevention : Clinical phase

    - Preventing complications and/or disability

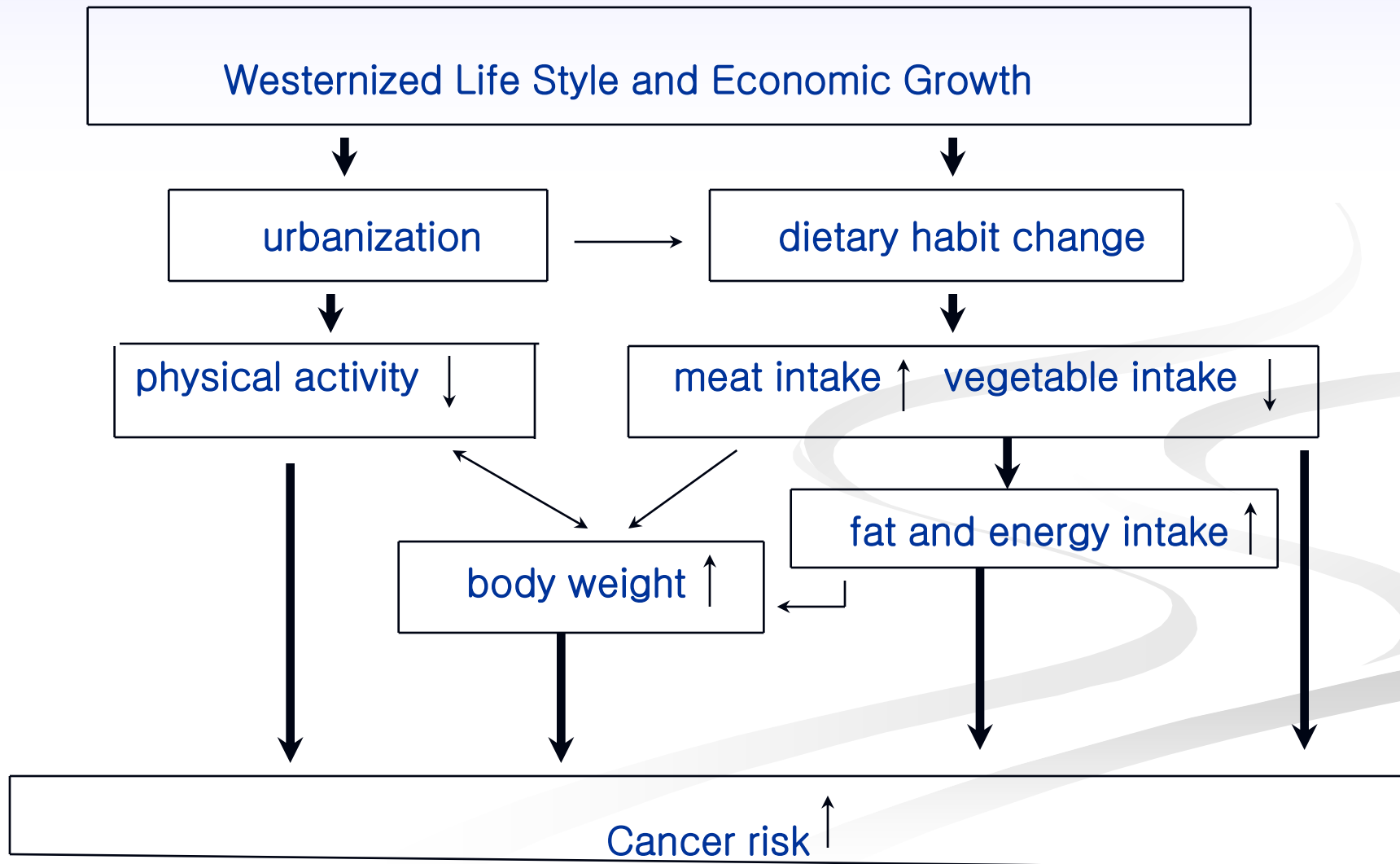   - preventing spread of the disease to other persons

질병 발생 설명 모형 (1)

- Epidemiologic Triangle (역학적 삼각모형, 지렛대 이론)

질병 발생 설명 모형 (2)

Causative web model (원인망 모형)

질병 발생 설명 모형 (3)

- Wheel model (수렛바퀴 모형)