Epidemiologia e Geologia Médica

Eduardo M. De Capitani
Faculdade de Ciências Médicas – CCI - UNICAMP

2005 WORKSHOP INTERNACIONAL DE GEOLOGIA MÉDICA
02 a 04 de JUNHO de 2005
Rio de Janeiro – Brasil

CPRM - Serviço Geológico do Brasil

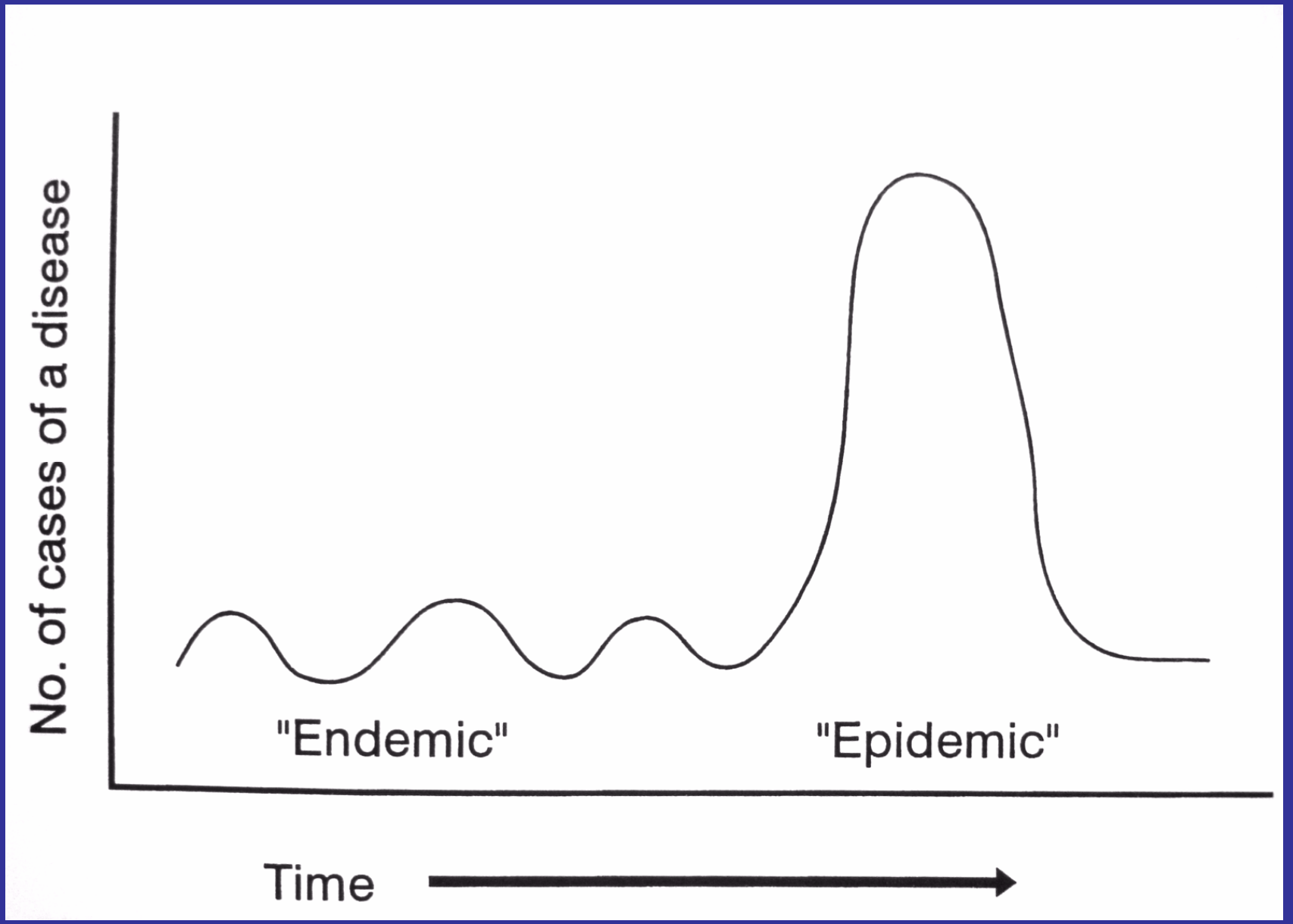
Epidemiology

- Study of HOW disease is distributed in populations and WHICH FACTORS influence or determine this distribution
- Descriptive
  - Time – when
  - Place – where
  - People – who
- Analytical
  - Related to cause-effect relationship, and risk factors

- **Disease or Health-related states or events**
  - **Symptoms (subjective complains)**
  - **Signals (objective perceptions)**
  - **Laboratory alterations**
  - **Levels of exposure**

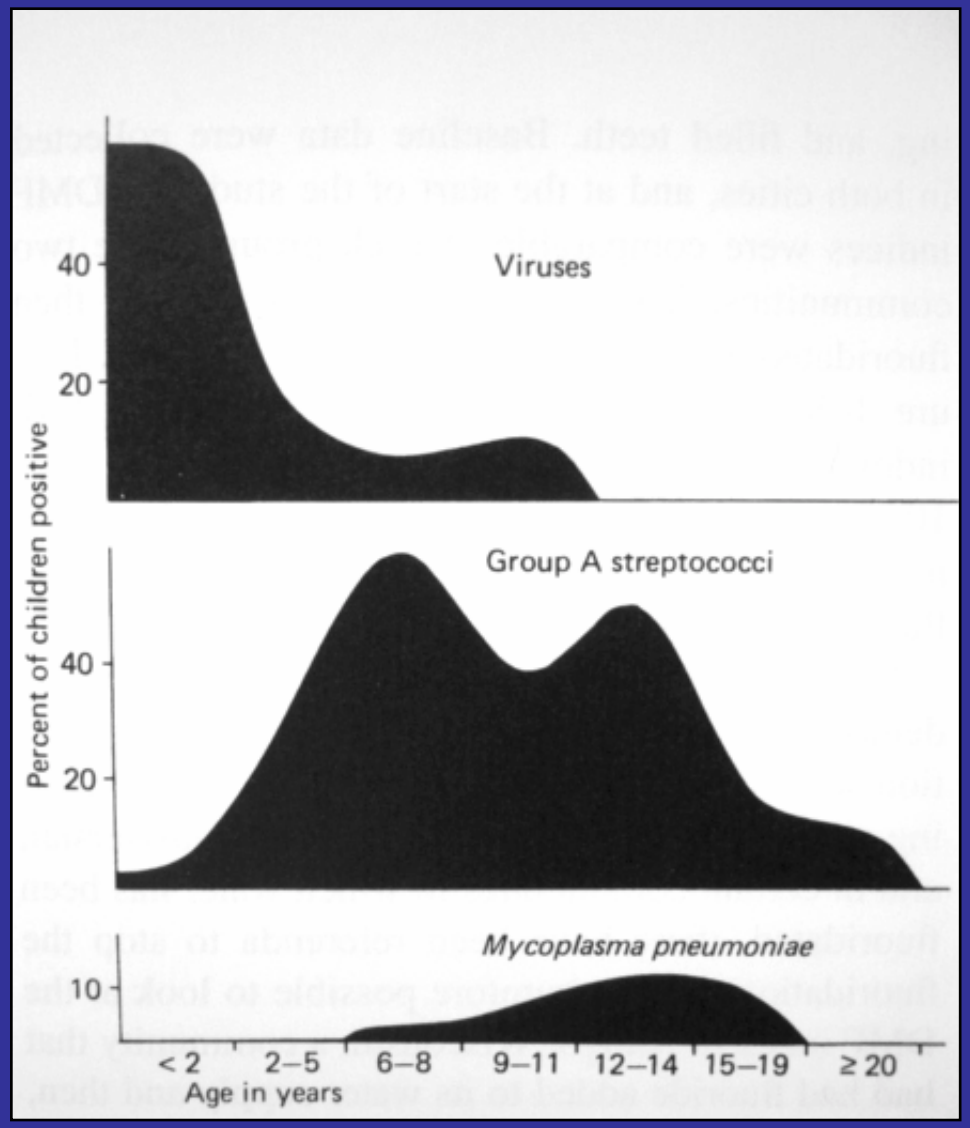
Objectives of epidemiology

- Determine the extent of the event in the population
- Study the natural history of the event:
  - How it begins, evolves, and finishes
- Determine the etiology:
  - Specific / multiple causal agents
  - Risk factors: genetics; environment; habits, etc.
  - Pattern of transmission
  - Pattern of exposure


No. of cases of a disease
"Endemic"
"Epidemic"
Time

EMDC2 EMDC3

Frequency of agents by age of children with pharyngites, 1964-65

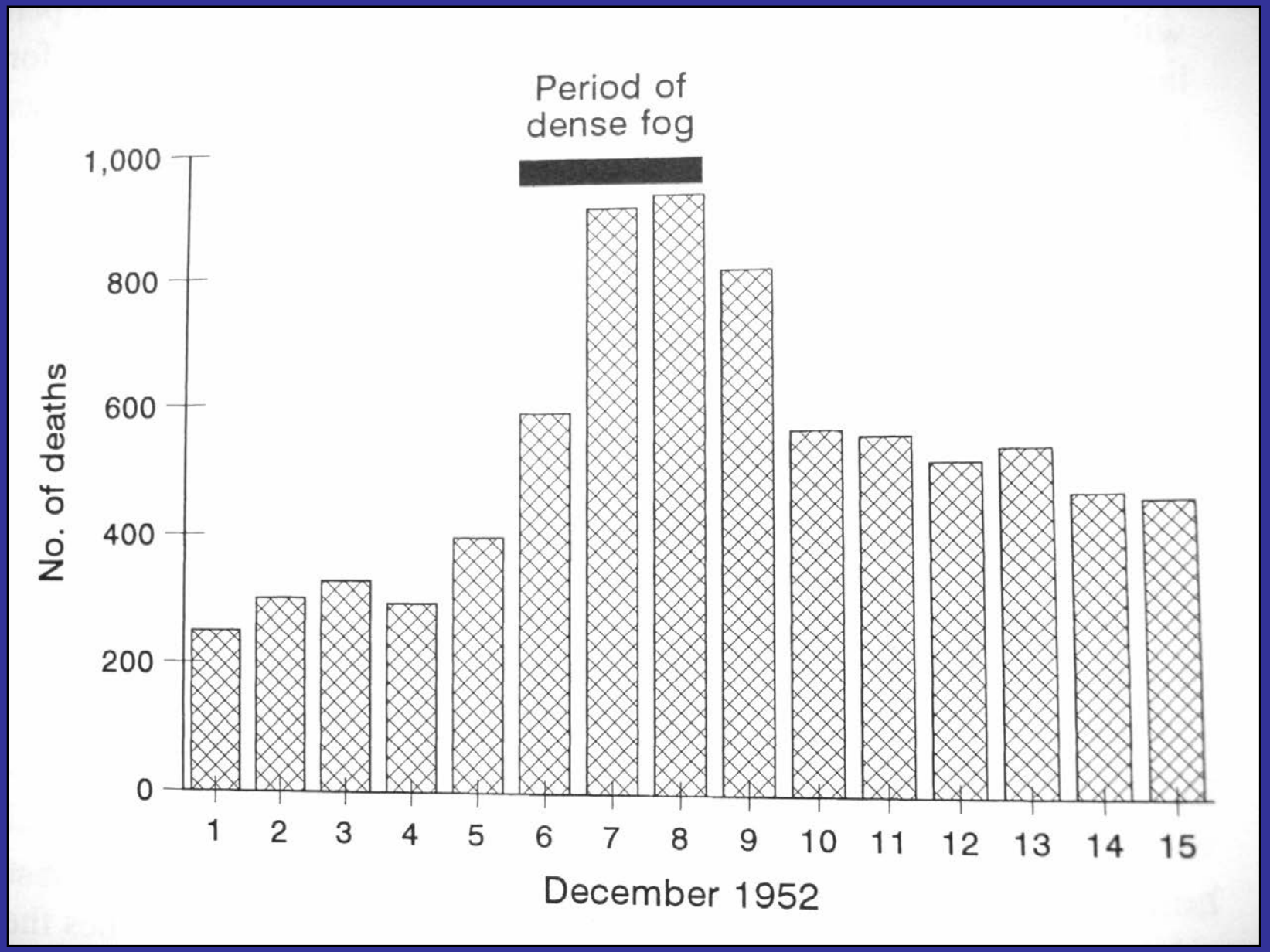


Source: Denny FW, 1969

EMDC2

Denny FW. The replete pediatrician and the etiology of lower respiratory tract infections. Pediatr Res 3:464-470, 1969
Eduardo Mello De Capitani; 17/5/2005

EMDC3 Cited in Gordis L, Epidemiology. Philadelphia, WB Saunders Co, 1996.p 7.
Eduardo Mello De Capitani; 17/5/2005



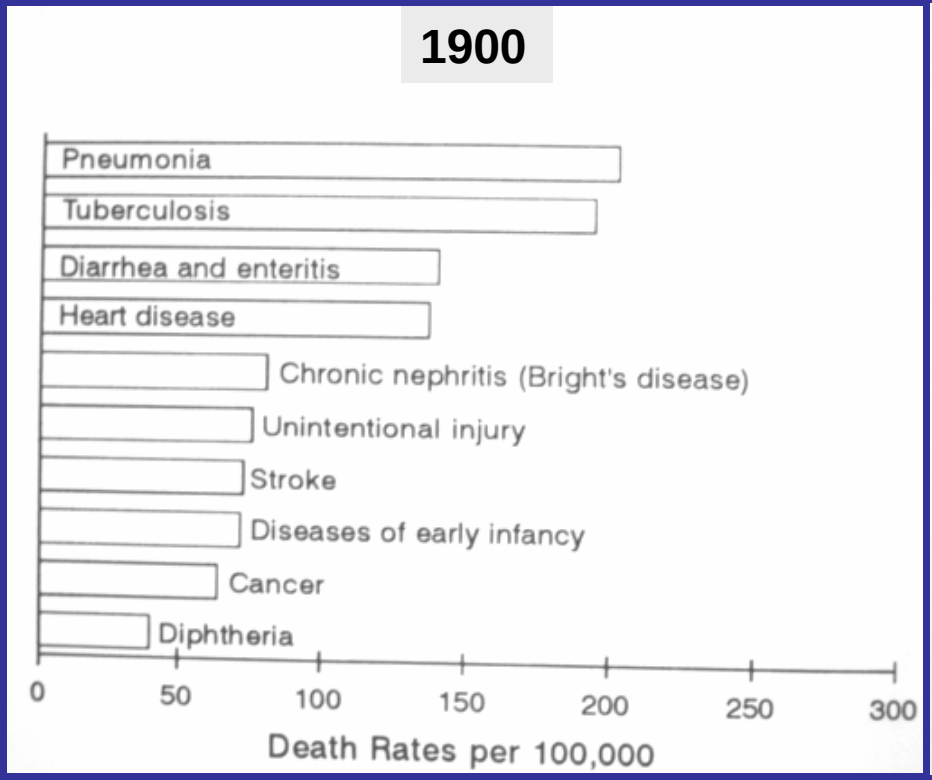
Logan WPD. Mortality in the London fog incident, 1952. Lancet 1:336, 1953

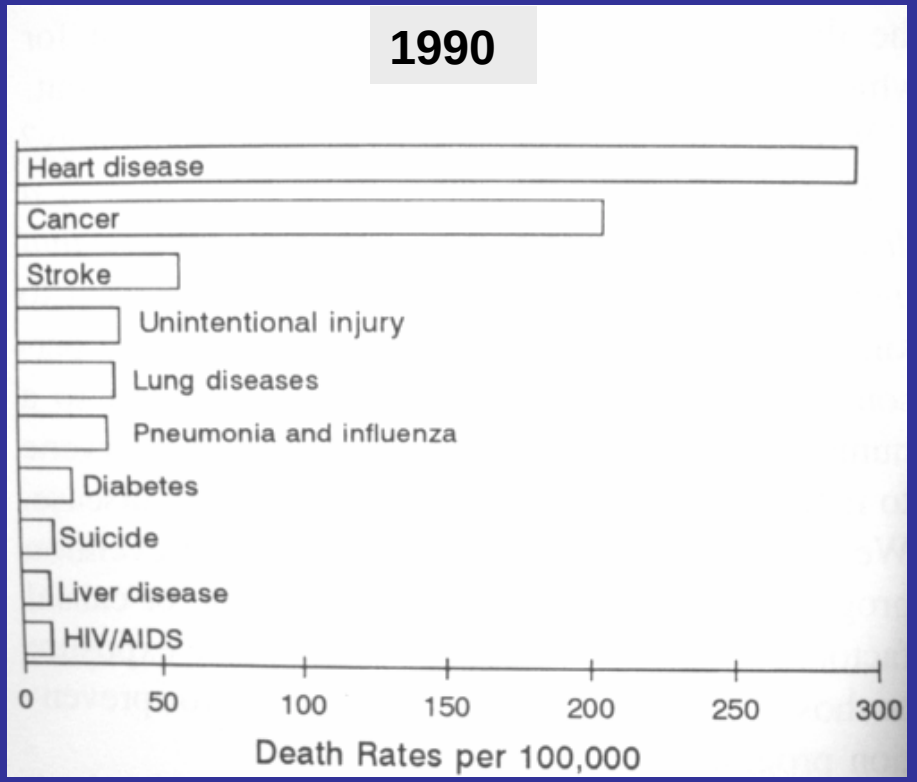
Objectives of epidemiology

- **Study the pattern of change of distribution of the event over time**
- **Define and assess therapeutic, preventive or control measures**
- **Provide rationale to public policies and regulatory decisions**

EMDC1

Ten leading causes of death in the USA, 1900-1990





Adapted from Grove RD & Hetzel AM, 1993

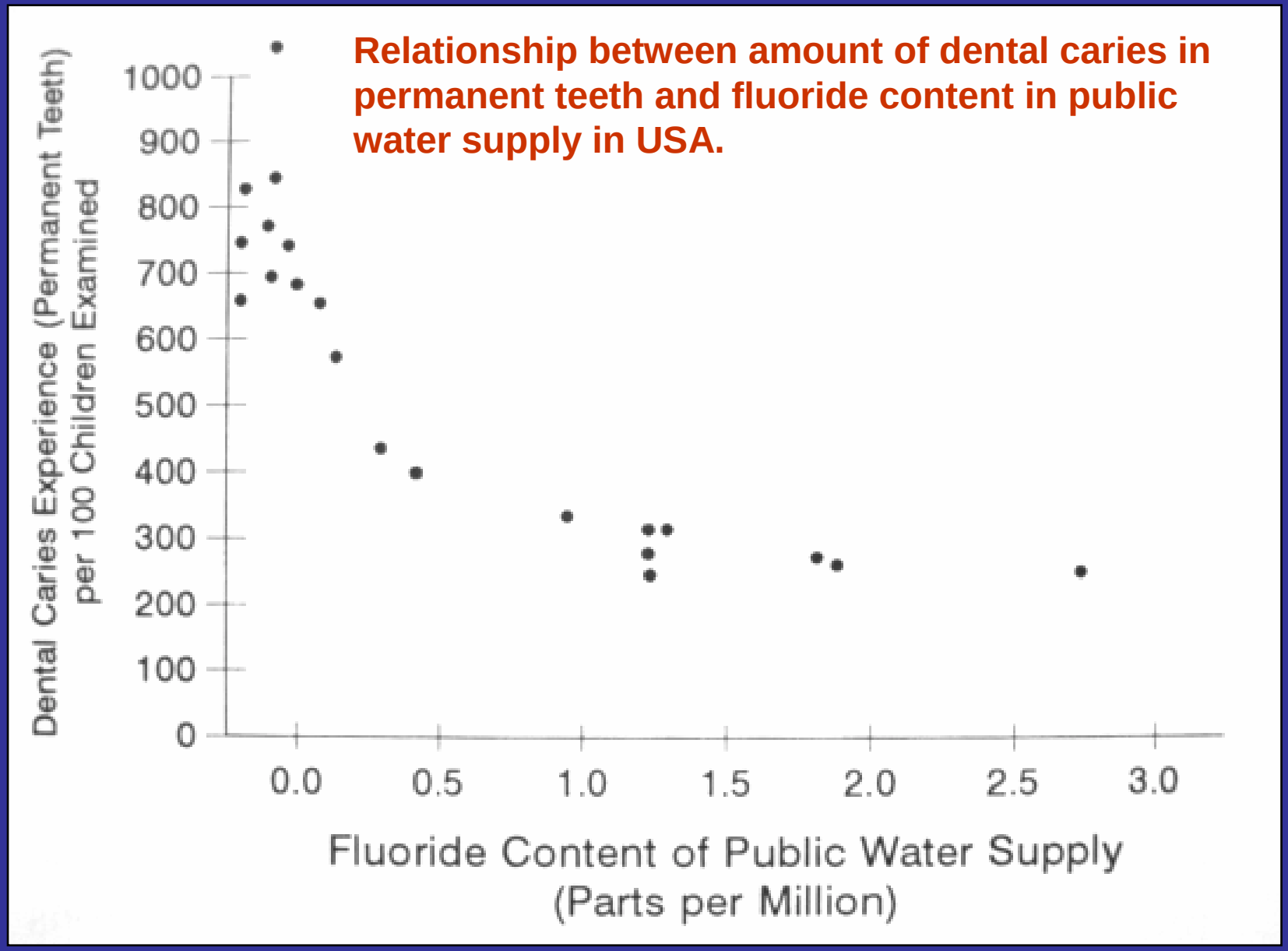
EMDC1

Grove RD, Hetzel AM. Vital statatistics of the USA, 1940-1960. Washington DC, US Government Printing Office, 1968, and National Center for Health Statistics: Advance report of final mortality statistics, 1990, Monthly Vital Stat Rep 41(7) suppl, 1993

Eduardo Mello De Capitani; 17/5/2005

EMDC4

Relationship between amount of dental caries in permanent teeth and fluoride content in public water supply in USA.

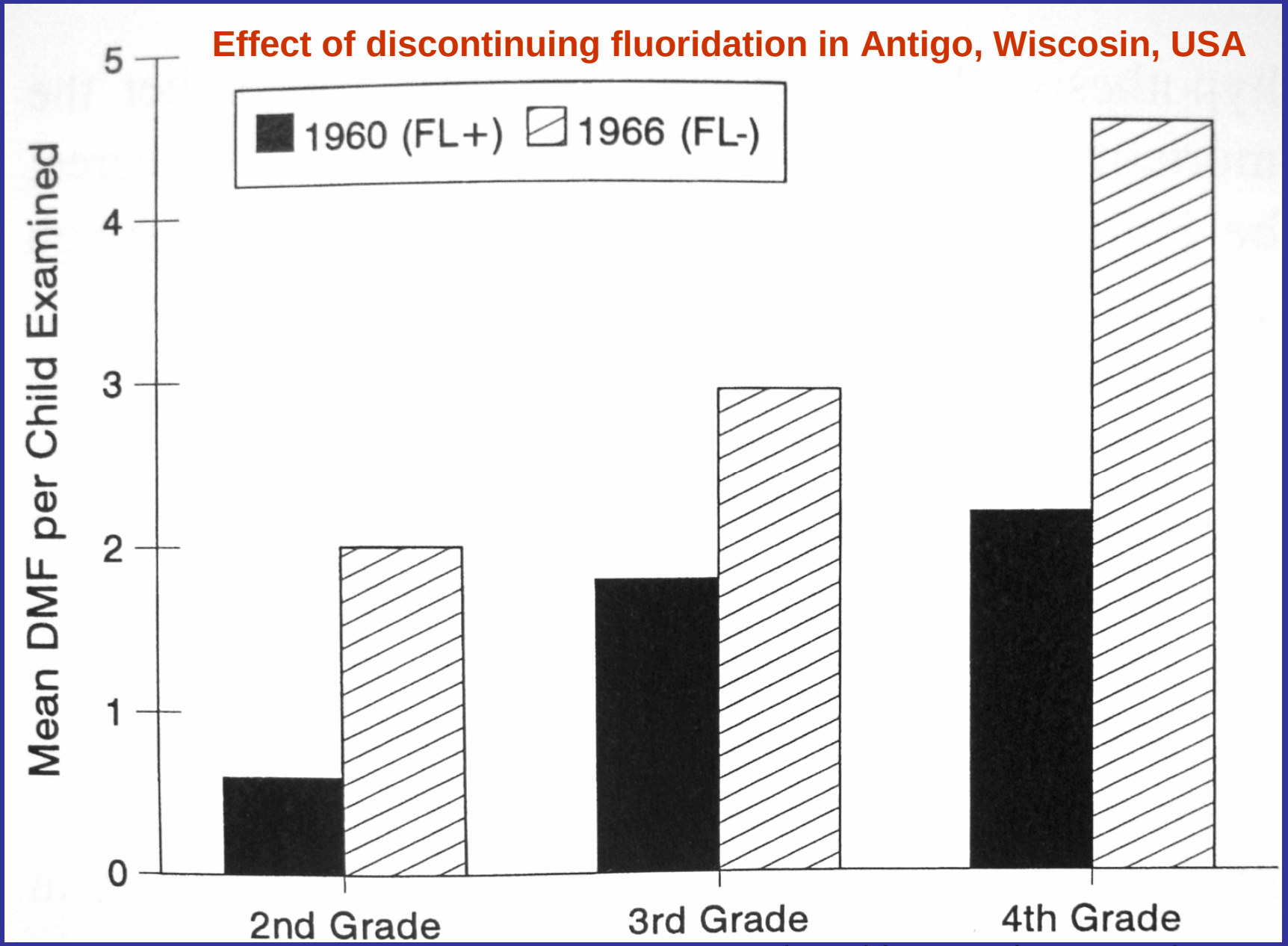


Adapted from Dean HT et al, 1942

EMDC4 Dean HT, Arnold FA Jr, Elvore E. Domestic water and dental caries: V. Additional studies of the relation of fluoride in domestic waters to dental caries experience in 4,425 white children aged 12 to 14 years of 13 cities in 4 states. Publ Health Rep 57: 1155-79, 1942. Citaed by Gordis L. Epidemiology. Philadelphia, W.B. Saunders Co, 1996.

Eduardo Mello De Capitani; 17/5/2005

Effect of discontinuing fluoridation in Antigo, Wiscosin, USA



Adapted from Lemke CW et al, 1970

Epidemiological approach

- **1. Determine whether an association exists between factor and the development of the disease or event**
  - **Describing characteristics of the factor and event**
    - **Incidence / prevalence**
    - **Exposure characteristics**
    - **People, Time, and Place**
  - **Association X Causation**
- **2. Derive inferences regarding a possible CAUSAL relationship between the two.**

Types of epidemiological studies

- **Observational**
  - **Descriptive**
    - **Prevalence / Incidence**
    - **Cross sectional**
  - **Analytical (search for etiology)**
    - **Case-control study**
    - **Cohort**
    - **Ecologic study**
- **Experimental**
  - **Randomized Clinical Trial**
  - **Community intervention**

Hill's criteria for causation

- **Strength**
  - **high relative risk**
- **Consistency**
  - **Causal relationship is supported by multiple studies in different populations, models or species**
- **Specificity**
  - **The observed effect does not occur without the presumed cause**

Modified from: Hill, AB. The environment and disease: association or causation? Proc R Soc Med 58:295, 1965

Hill's criteria for causation

- **Temporality**
  - **Cause should precede effect**
- **Biological gradient**
  - **There should be a good dose-response curve ("the threshold issue")**
- **Plausibility**
  - **Current biological knowledge should support the association**

Modified from: Hill, AB. The environment and disease: association or causation? Proc R Soc Med 58:295, 1965

Hill's criteria for causation

- **Coherence**
  - **The association should not conflict with generally known facts**
- **Experiment**
  - **The association should be demonstrable with a well design study**
- **Analogy**
  - **Resemblance with another causal relationship already accepted**

Modified from: Hill, AB. The environment and disease: association or causation? Proc R Soc Med 58:295, 1965

Cadmium pollution in the Usui river basin in Japan

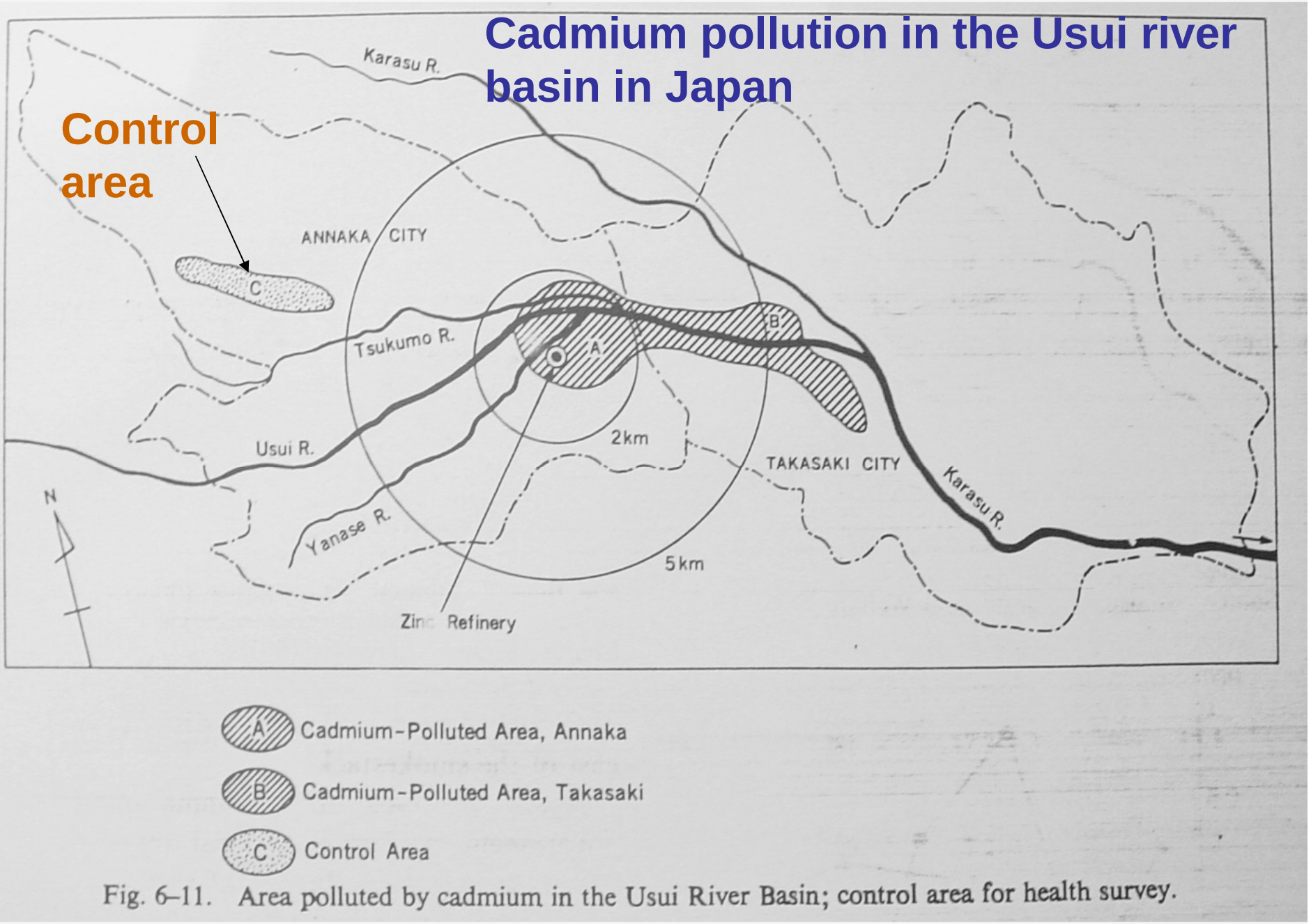


Fig. 6–11. Area polluted by cadmium in the Usui River Basin; control area for health survey.

Questions to be answered

- **Disease or event:**
  - **detailed description (osteomalacia / osteoporosis; deformity; pain)**
- **Local incidence / prevalence**
  - **(strength)**
- **Difference with other similar area**
  - **control area**
- **Kind of “abnormal” exposure**
  - **Cd and other metals**

Questions to be answered

- **Dose response relationship**
  - **Women in far areas with less symptoms**
- **Temporality**
  - **Situation before WWII and after**
- **Plausibility**
  - **Cd is a known cause of renal damage**
- **Specificity**
  - **disease can occur in absence of Cd exposure (discard other possibilities)**

Causal-effect validation criteria

• Strength	+ / -
• Consistency	-
• Specificity	+ / -
• Temporality	+
• Biological gradient	+
• Plausibility	+
• Coherence	+
• Experiment (lab)	+
• Analogy	+ / -