Dr. Data

Pediatrician Atul Butte:

Computing New Understandings of Disease

Butte Computes Disease

Photo: Steve Gladfelter

Pediatrician Butte studies genes to find new uses for existing medicines

Nosology

- Science of classifying diseases

- Categorizes diseases by symptoms and anatomy

Question:

Can different diseases have similarities?

Findings

Department of Health and Human Services
National Institutes of Health
National Institute of General Medical Sciences

Answer: Yes

Diseases with different symptoms can have similarities

- Diseases with different symptoms may affect the same body system

- Diseases affecting different body systems can have the same symptoms

- Some different diseases are very similar at the level of genes

A Genomic Surprise

	Heart Attack	**Muscular Dystrophy**
Age group affected	Older people (usually)	Toddlers and youth
Lifestyle triggers	Yes (usually)	No
Prognosis	Usually treatable	Uncurable
Available medicines	>40	1

Butte's discovery: **Heart attack and muscular dystrophy alter the activity of the same group of genes.**

Findings

Department of Health and Human Services
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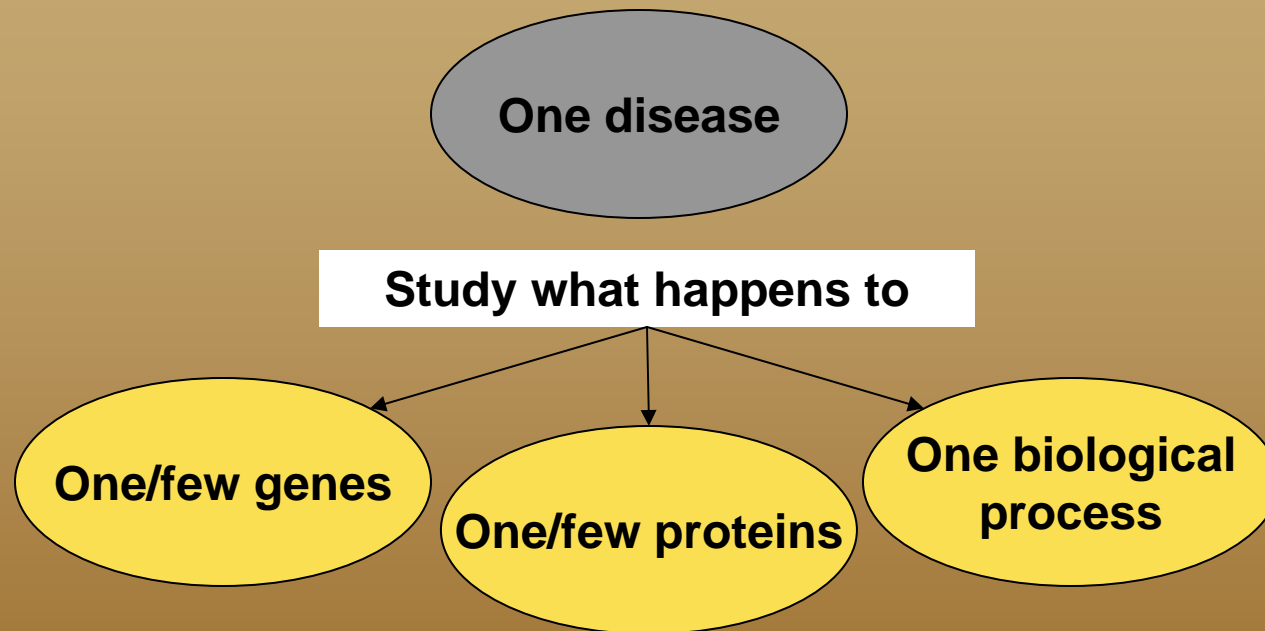
Old Models of Classification

MANUAL OF THE INTERNATIONAL LIST OF CAUSES OF DEATH

SECOND REVISION, PARIS, 1909
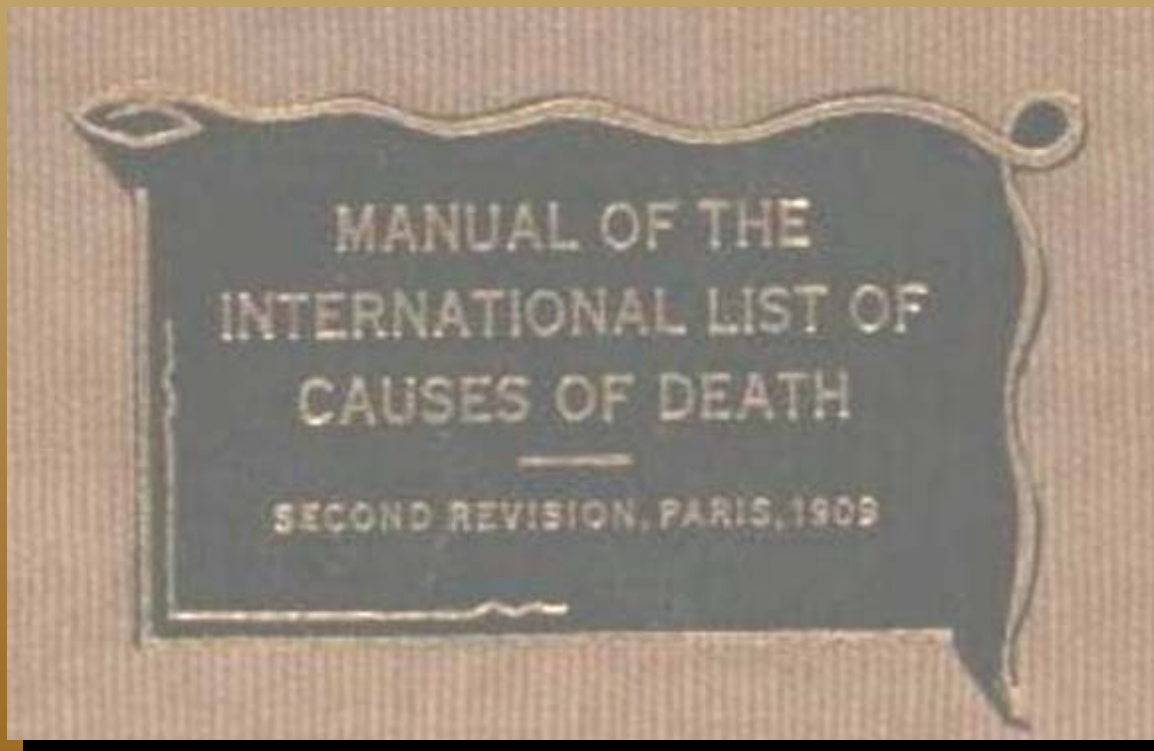
- Published in 1909

- Contains codes for common causes of death

Findings

Traditional Model of Medical Research

One disease

Study what happens to

**One/few genes**

One/few proteins

One biological process

RESULT:

1. **Understanding about how one disease affects the activity of one biological process**

Findings

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Butte's Approach

Measure activity of all genes in the human genome

↓

Find gene activity overlap to

↓

Many diseases
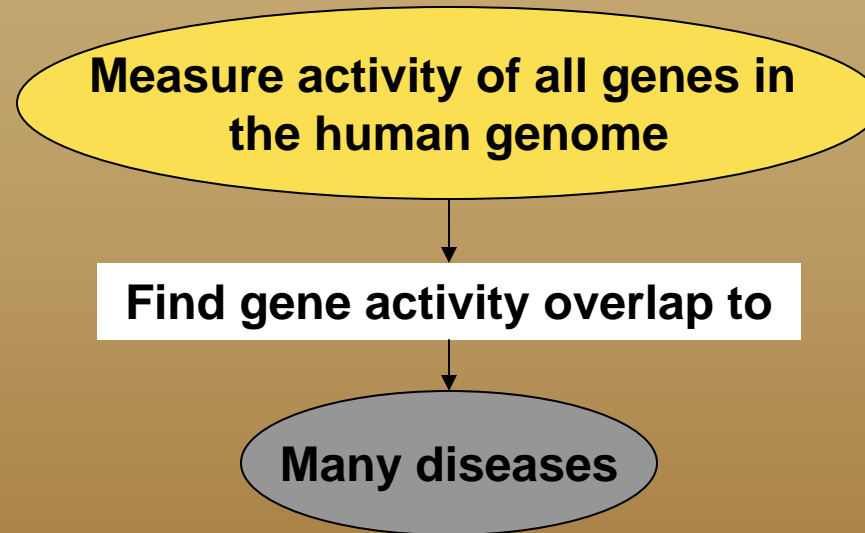
RESULT:

1. **Understanding about the activity of genes across diseases**

2. **Connections between different diseases at the genetic level**

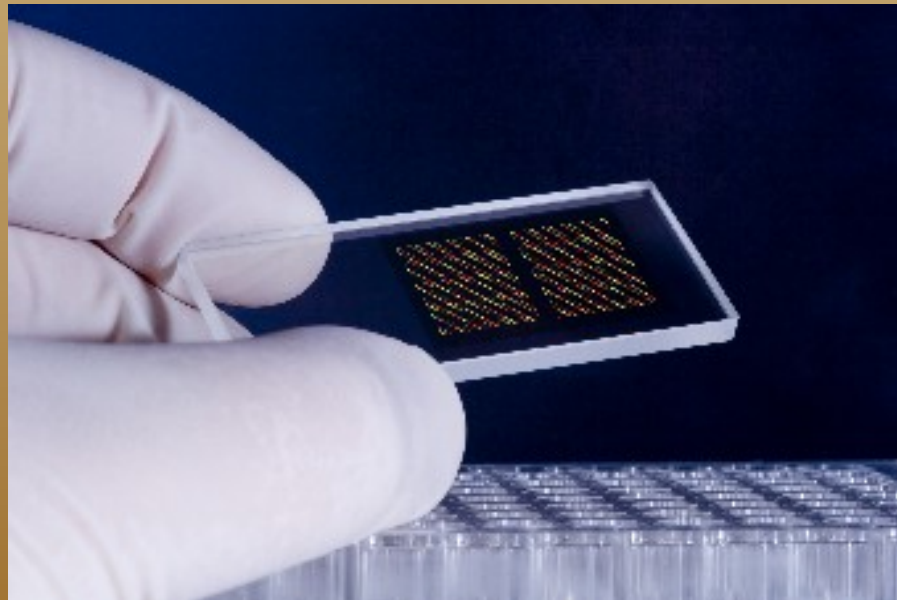3. **Possibility of using existing medicines for one disease to treat another disease**

Findings

Research Tools: Microarrays

Microarray

- Also called "DNA chip" and "gene chip"

- Thumbnail-sized

- Microscopic grid

- Contains pieces of DNA representing every gene in the genome

The Power of GEO

Genome **E**xpression **O**mnibus

- Database

- Repository for results of studies using microarrays

- 1,000 samples uploaded weekly

- Can be used for bioinformatics experiments

Findings

Advances in Disease Research

- Multiple microarrays

  How are these useful to scientists studying disease?

- The amount of life-science data

  What challenges does this create?

- A genome-based disease classification system

  How is this different from current disease classification systems?

Findings

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Research Applications

What are some implications of using existing medications to treat diseases other than those they initially were developed to treat?

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