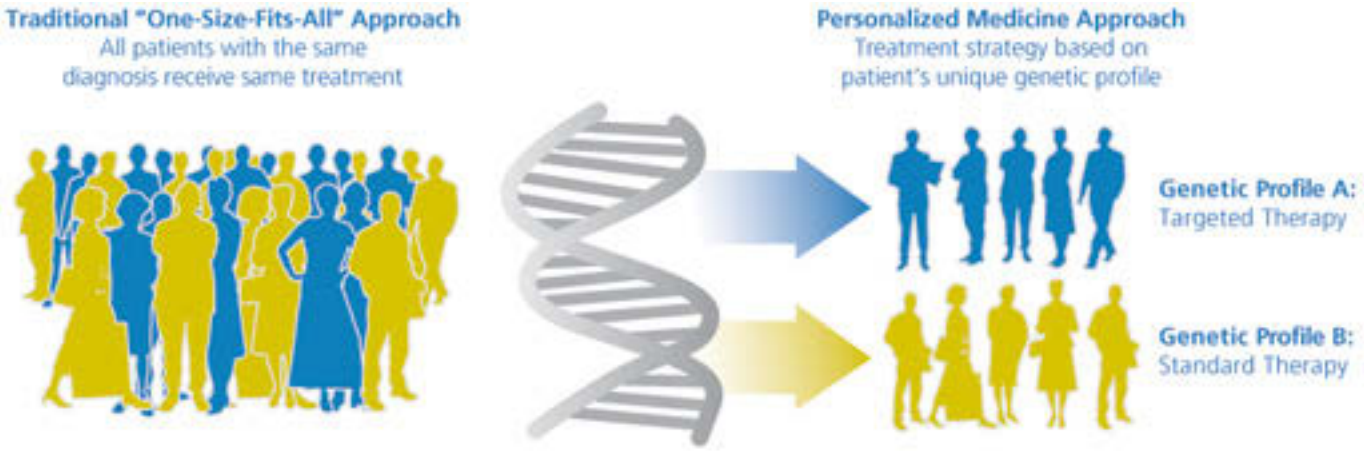
Genomic Medicine: A Primer

Michelle Amaral, PhD
UAB Heflin Center
Study Navigator

Heflin Center for Genomic Sciences

Background

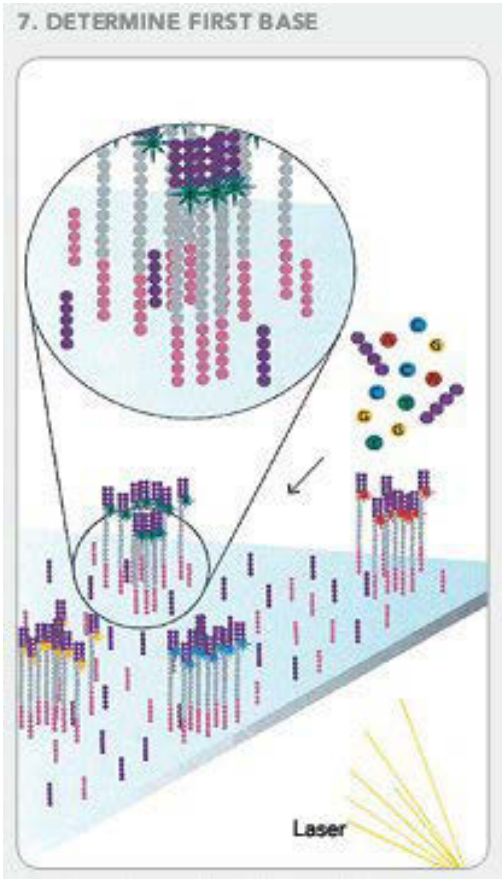
- Human Genome Project, 2003



- Uses *personal* genomic data to better predict, diagnose, and treat disease

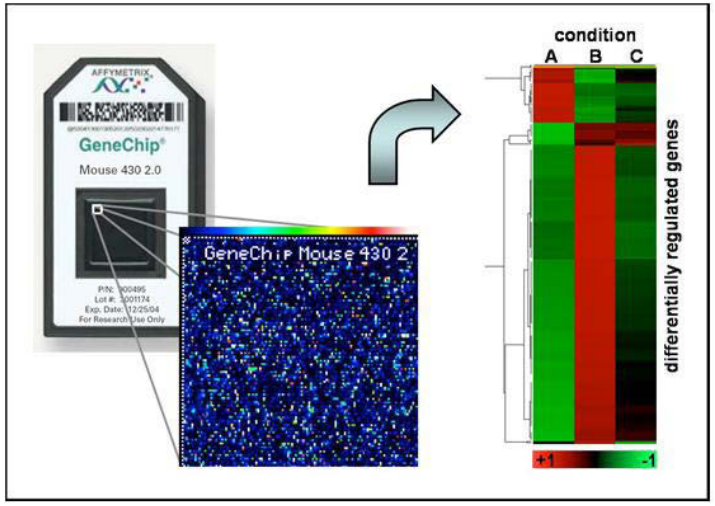
Genomic Technologies

- Next generation sequencing
  - Massively parallel sequencing



Genomic Technologies

- Array-based assays
  - Gene expression profiling
  - Genotyping

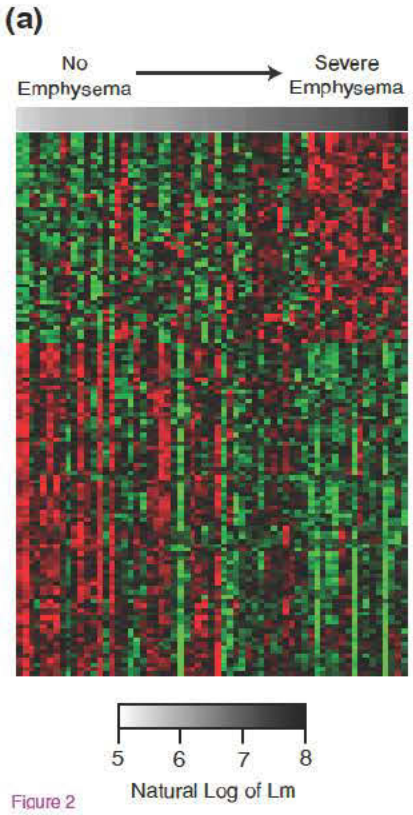


Example

- 19 year old male collapsed & died during hockey game
- **Autopsy:** autosomal dominant arrhythmogenic right ventricular cardiomyopathy
  - DNA test detected deletion of gene encoding desmoglein 2
- **Could his life have been spared?** Microarray test would have detected deletion
- **Family testing?** Benefits from early detection

Buchanan JA *et al*. *Genome Medicine*, 2009

Study: Emphysema and COPD



B-cell receptor signaling pathway

TGFβ pathways and cellular structure, blood vessel morphogenesis, vascular endothelial growth factor, extracellular matrix production, integrin signaling

Campbell JD *et al*. *Genome Medicine*, 2012

Ethical Issues

- Consent forms
  - Research vs patient care
- Examples
  - Study: genetic changes in colon cancers
  - Family history of breast cancer

ENCODE Project

- Less than 2% of genome encodes for proteins
- Goal: determine function of the remaining 98%
  - About 80% is dedicated to regulation
    - Enhancers
    - Promoters
    - Non-protein encoding RNAs
- **Variants correlated with disease lie within or very near non-coding functional DNA elements**