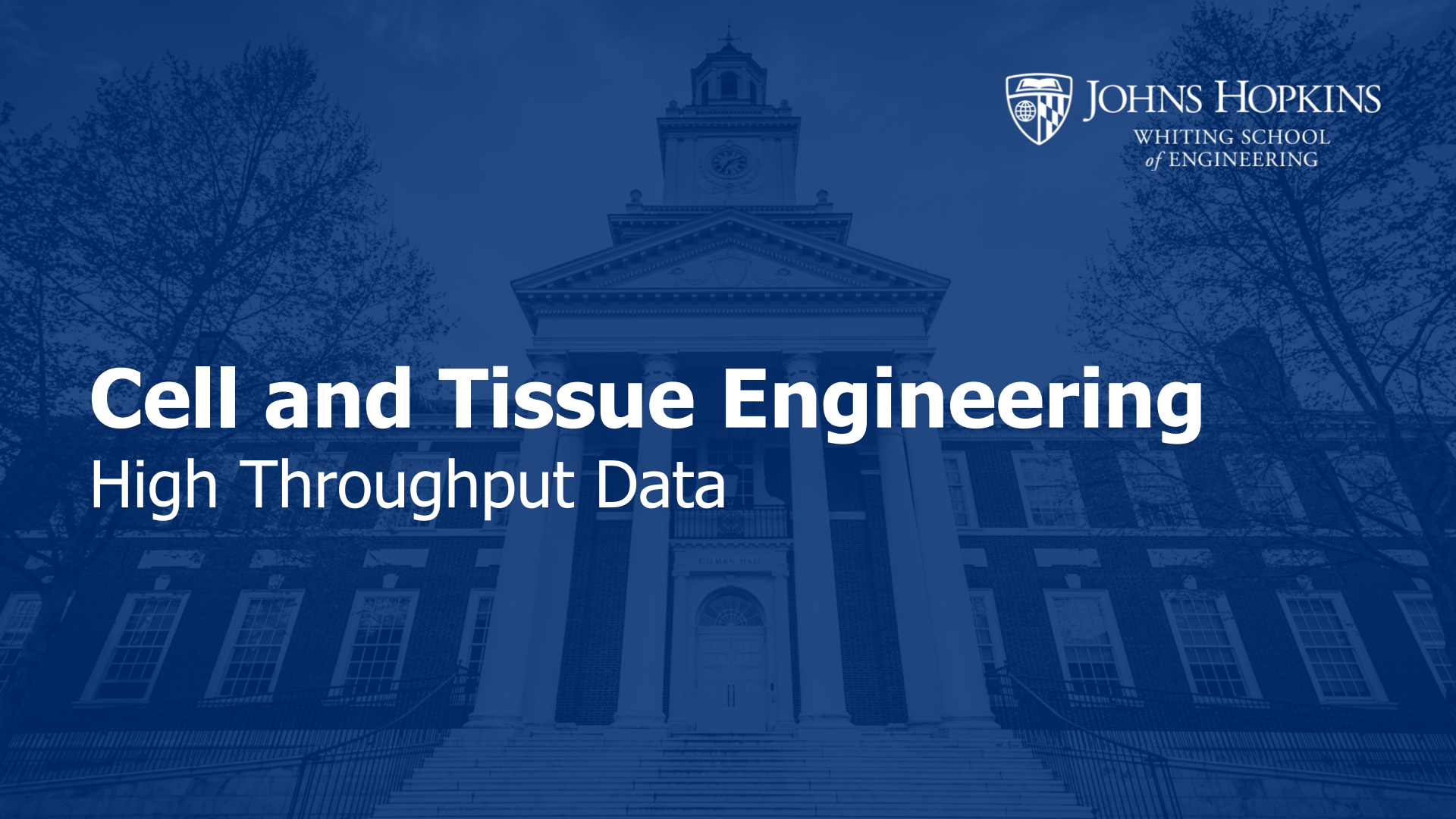
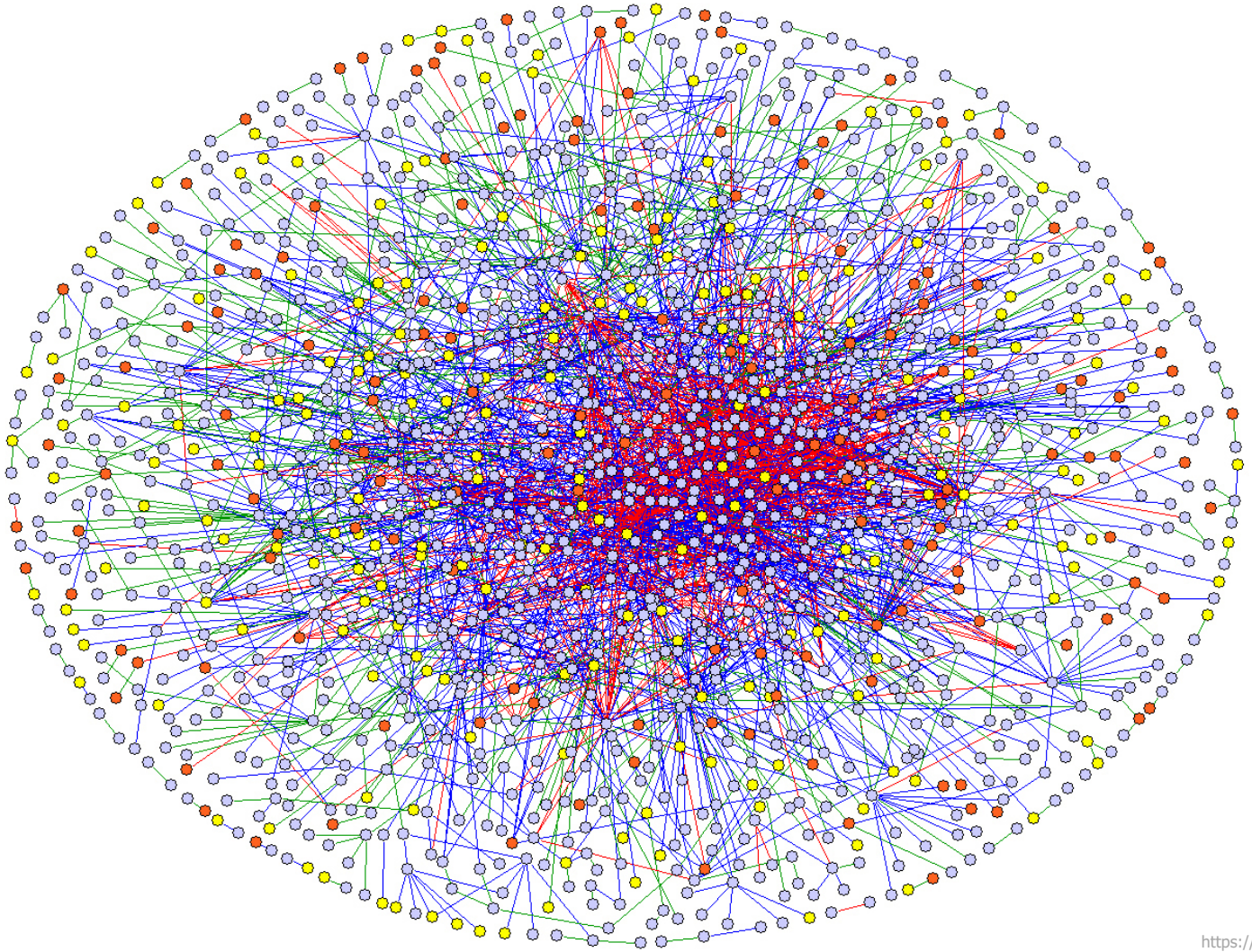


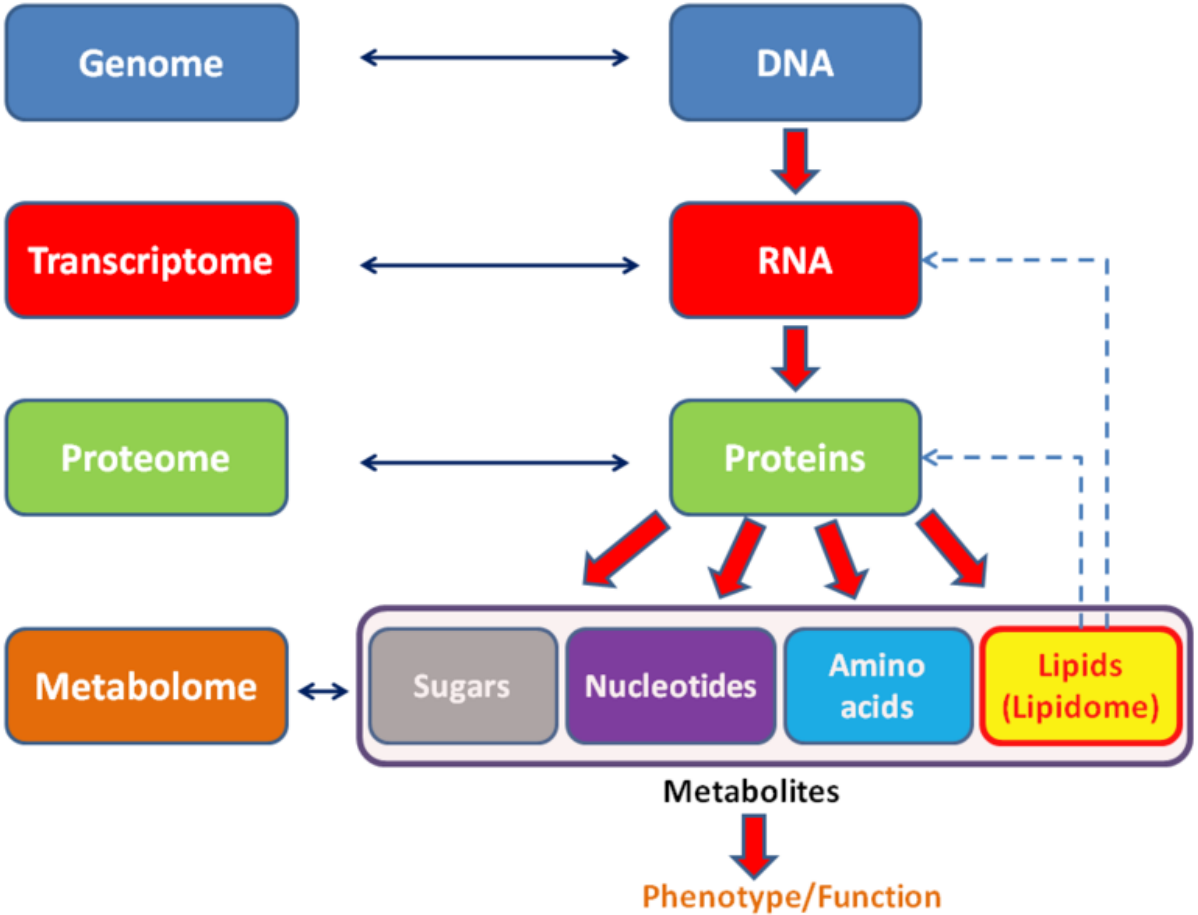
Cell and Tissue Engineering

High Throughput Data



https://www.mdc-berlin.de

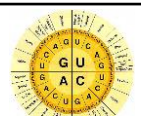
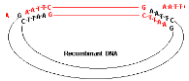
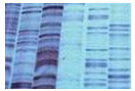
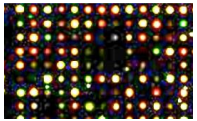
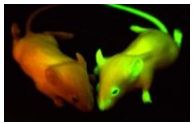
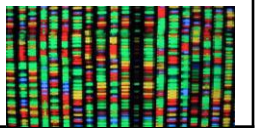
Phenomics



http://en.wikipedia.org/wiki/

Genomics

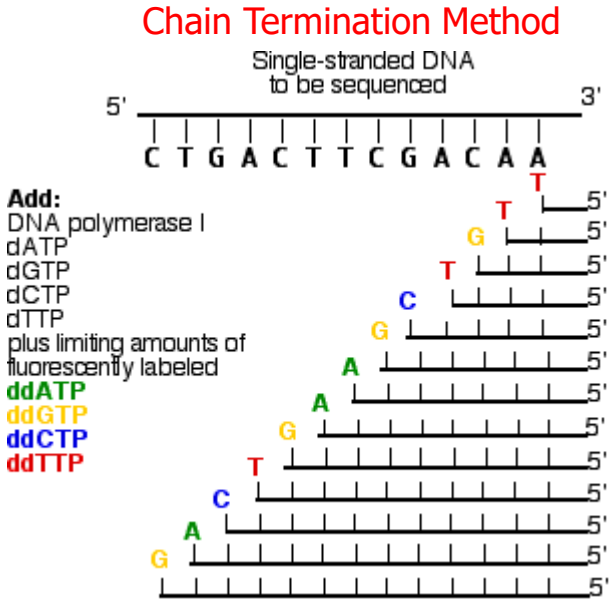
pharmacogenomics

Decade	Milestone	
1950s	Structure of DNA discovered	
1960s	Genetic code broken	
1970s	Recombinant DNA technology	
1980s	DNA sequencing technology	
1990s	Whole-genome sequencing DNA Chip technology Patient-specific treatment	
2000s	Biodiversity Designer organisms	
>2000s	Sequencing the human genome Genotype-phenotype relationship	

Adapted from Tissue Engineering, Palsson & Bhatia
www.astrochem.org
www.millerandlevine.com
www.ocf.berkeley.edu
www.prism.gatech.edu
www.australiangeographic.com.au
www.glogster.com

Genomics (cont.)

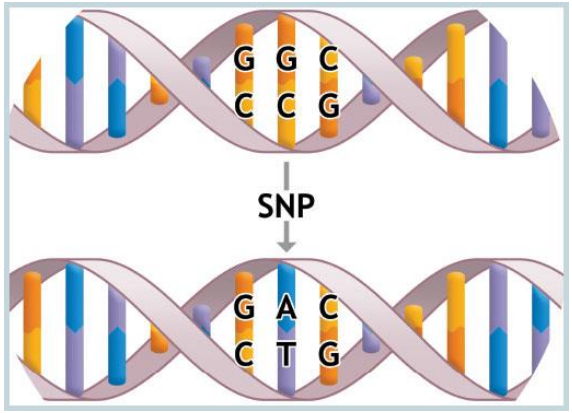
- Genomics – the study of genomes
- International Nucleotide Database Collaboration
  - NIH Gene Bank
  - European Molecular Biology Laboratory (EMBL)
  - DNA Databank of Japan (DDBJ)



Using Genomics

- Sequencing Similarity
- Sequence Variation

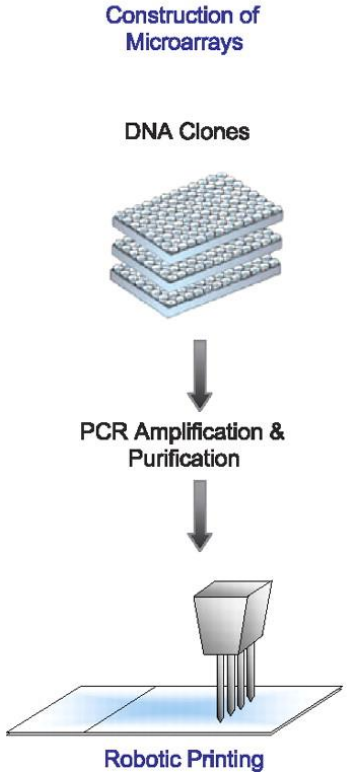
- SNPs – single nucleotide polymorphisms



Diabetes
Cancer
Alzheimer's disease

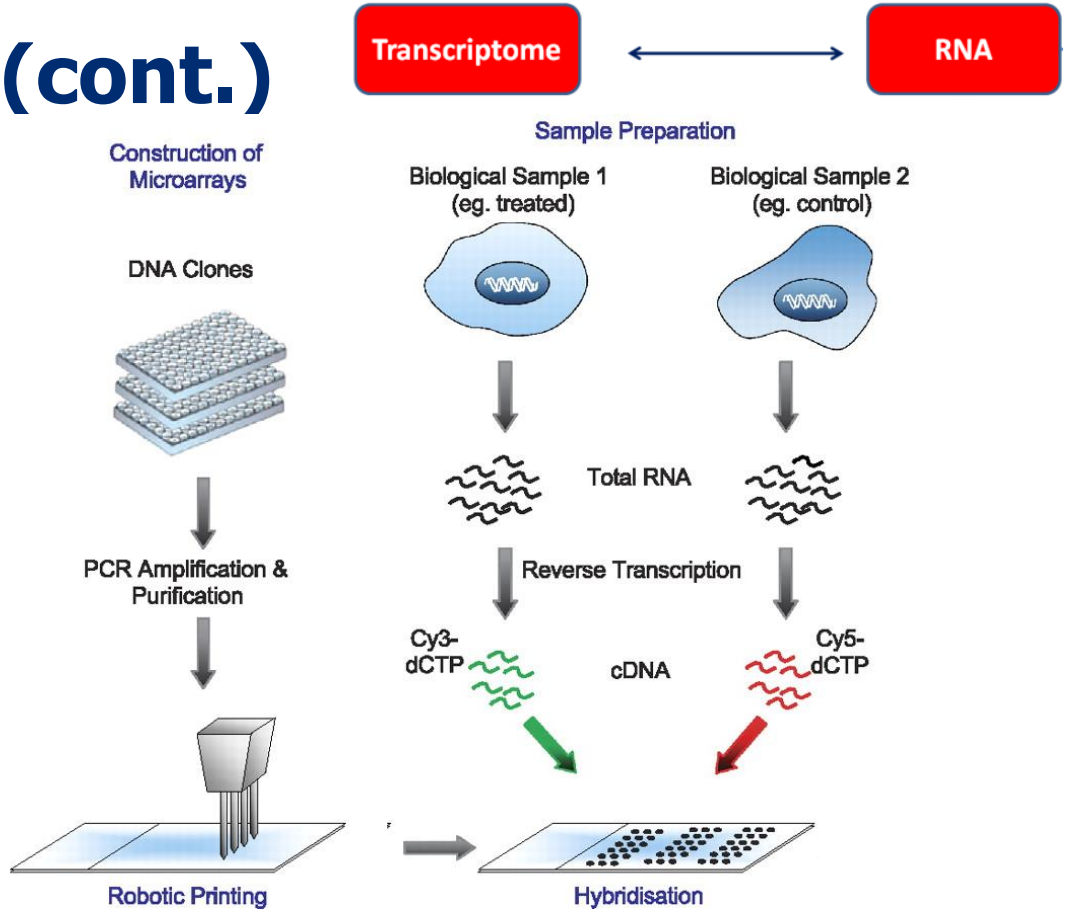
Transcriptomics

- Expression Arrays



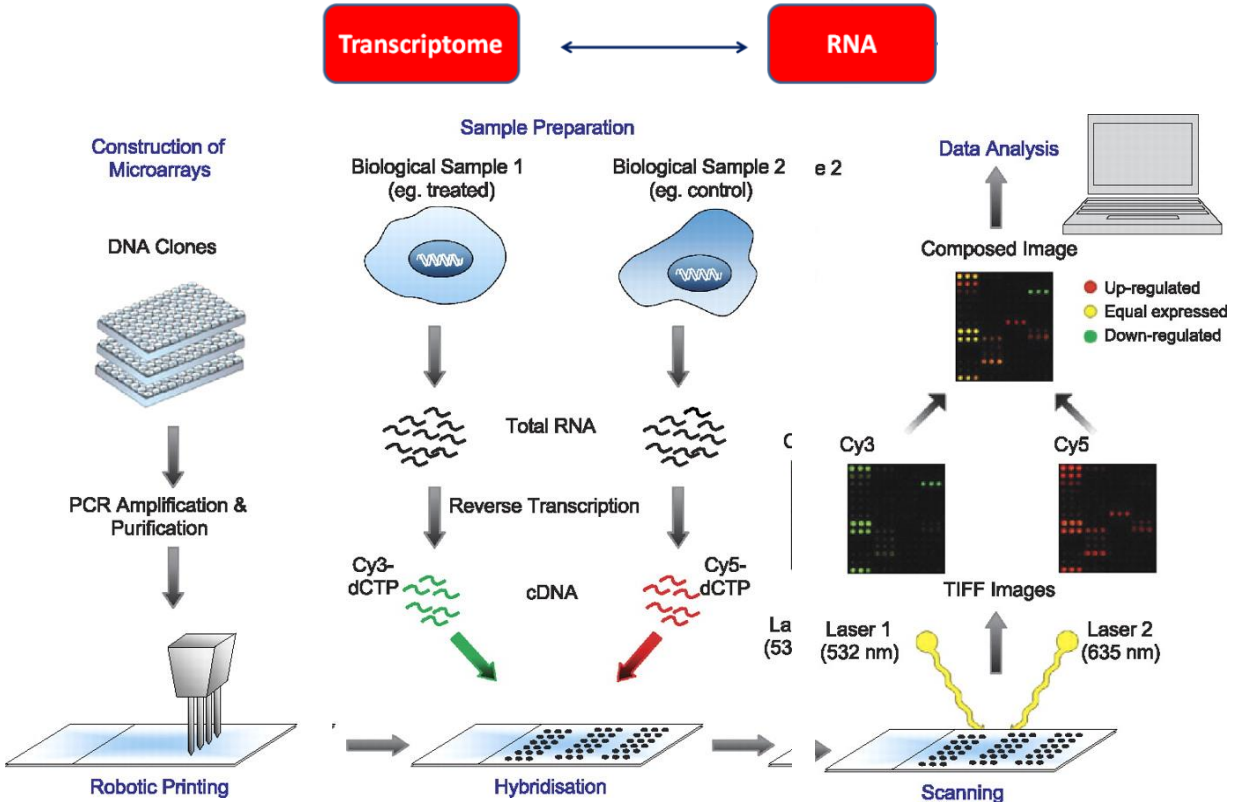
Transcriptomics (cont.)

- Expression Arrays



Expression Arrays

Transcriptomics (cont.)



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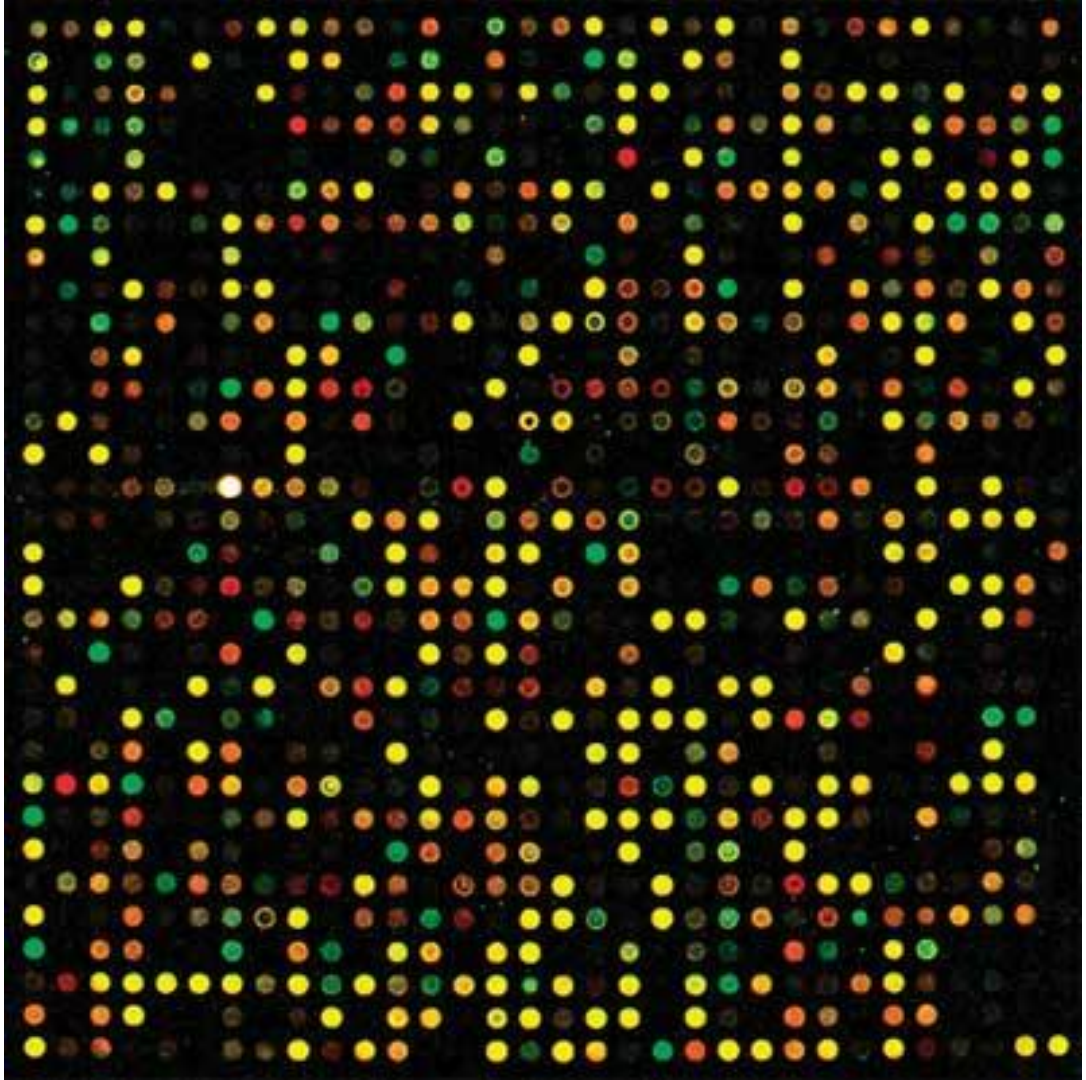
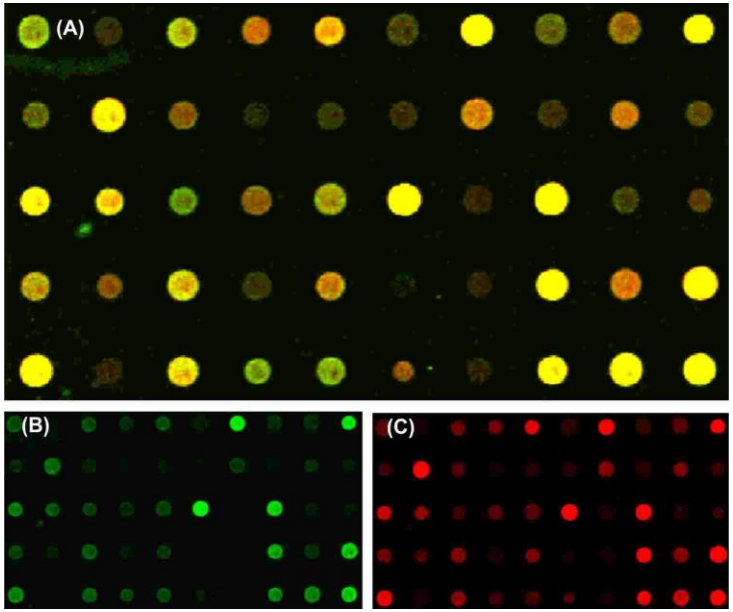


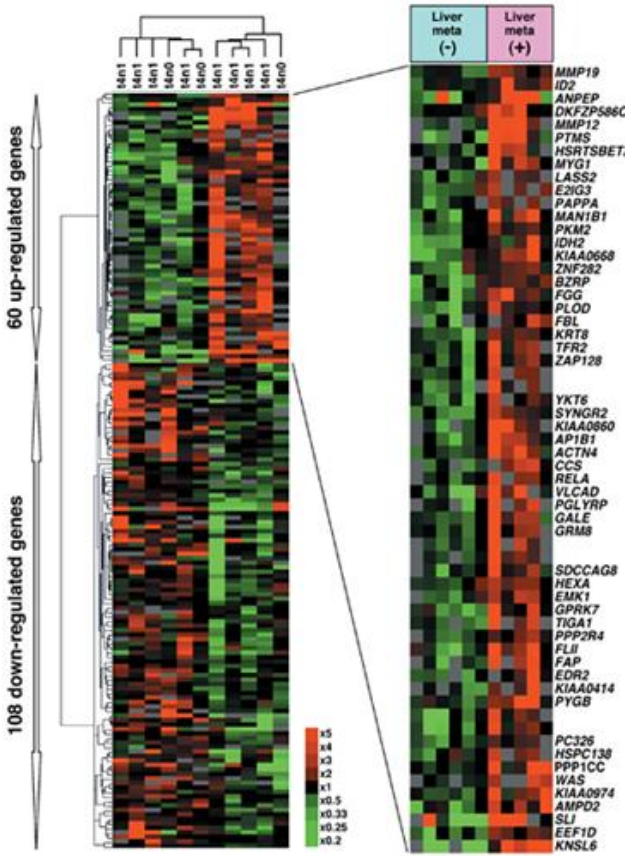
Microarray data analysis

1. Image Processing
2. Normalization
3. Identifying differentially expressed genes
4. Data analysis
5. Choosing a metric



Microarray data analysis (cont.)

1. Image Processing
2. Normalization
3. Identifying differentially expressed genes
4. Data analysis
5. Choosing a metric
   - "guilt by association"



Microarray analysis – gene expression profiling

- **How do we use it?**
  - Classification
    - disease state
    - disease subtype
    - appropriate treatment

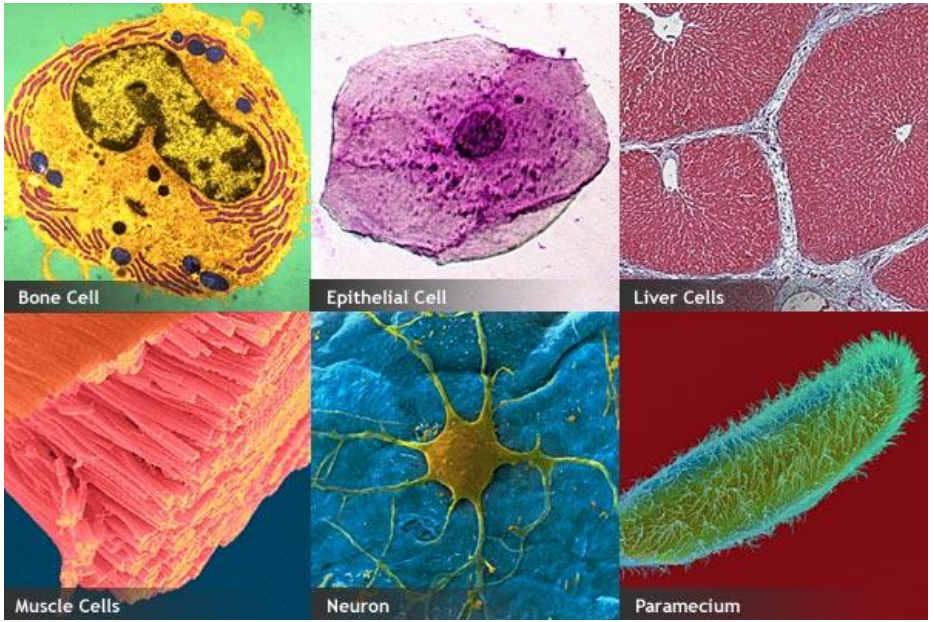
oncotype DX® Breast Cancer Assay

mammaprint™ decoding breast cancer.

Clarient Insight Dx Mammostrat®

Microarray analysis – gene expression profiling (cont.)

- **How do we use it?**
  - Cell differentiation or tissue specification

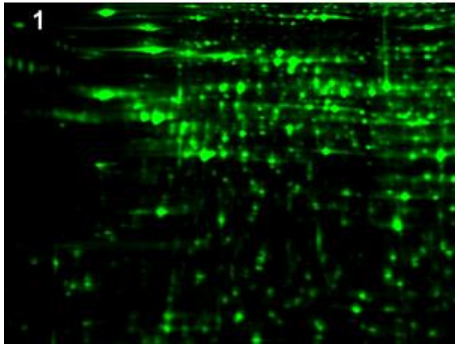


Proteomics

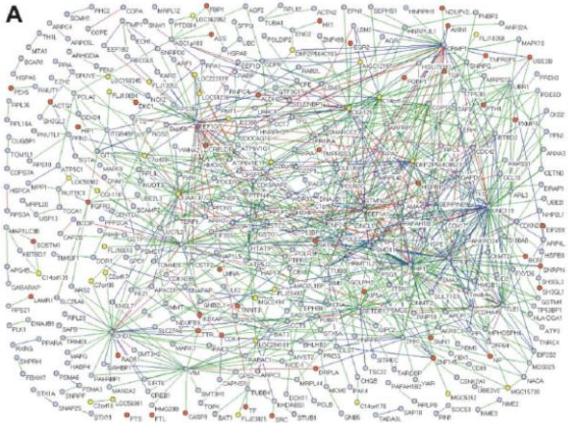
- Structure
- Expression
- Function

Proteome ⟷ Proteins

Expression Profiling



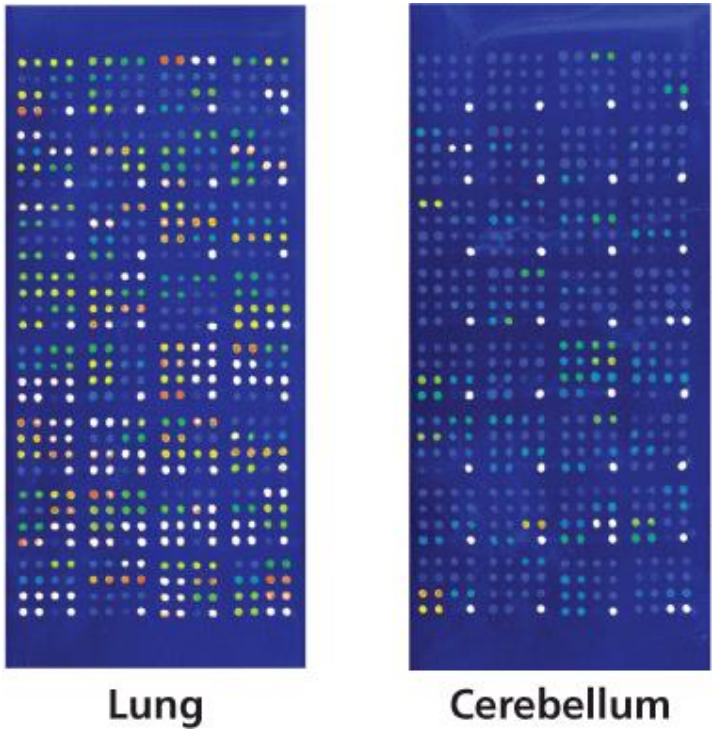
Interaction Maps



http://ac.els-cdn.com; Applied Biomics

Proteomics (cont.)

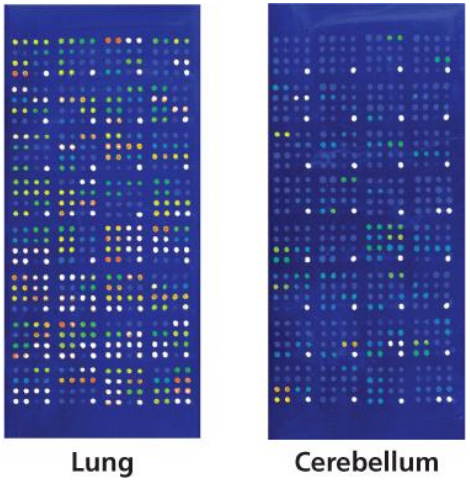
- Expression Profiling



Millipore Sigma; http://ac.els-cdn.com

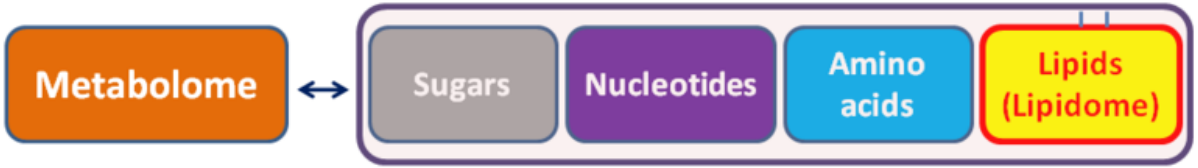
Proteomics (cont.)

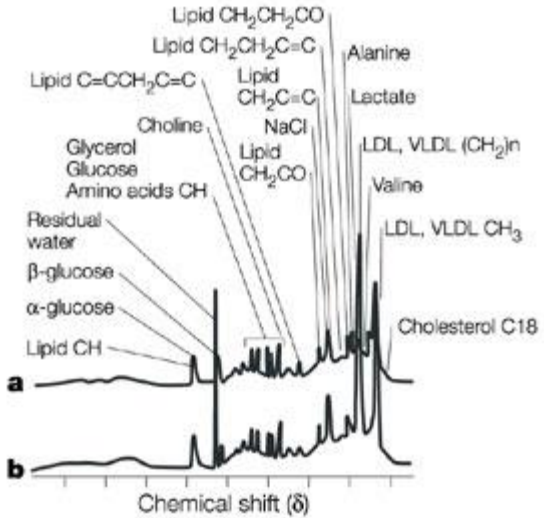
- Expression Profiling



- Interaction Maps

Metabolomics





a – NMR of a health patient
b – NMR of a patient with atherosclerosis

Metabolomics (cont.)

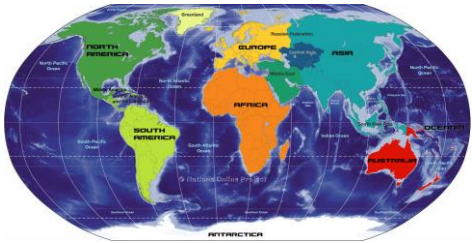
- Target analysis –
  - the effect of one gene on the concentration of one metabolite
- Metabolite profiling –
  - the effect of several genes or a pathway on a metabolite
- Fingerprinting –
  - qualitative measure of a number of metabolites
- Metabolomics –
  - quantitative measure of all metabolites

Metabolomics (cont.)

- Human Metabolome Project
  - Chemical data
  - Clinical data
  - Molecular biology/biochemistry data
  - >40,000 metabolites

Phenomics

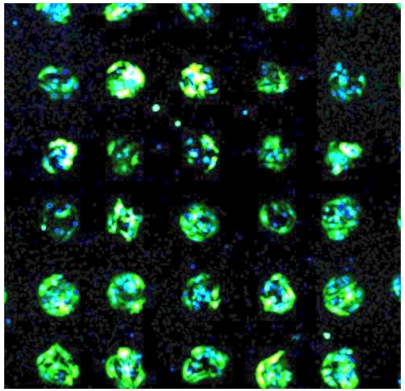
- The study of how genes interact with the environment giving rise to characteristics



UC SD News
redrome.jpg
rover.ebay.com
Cicis pizza
Nations Online Project

Phenomics (cont.)

The study of how genes interact with the environment giving rise to characteristics



THE HUMAN VARIOME PROJECT

Physiome Project

MEETING REPORT

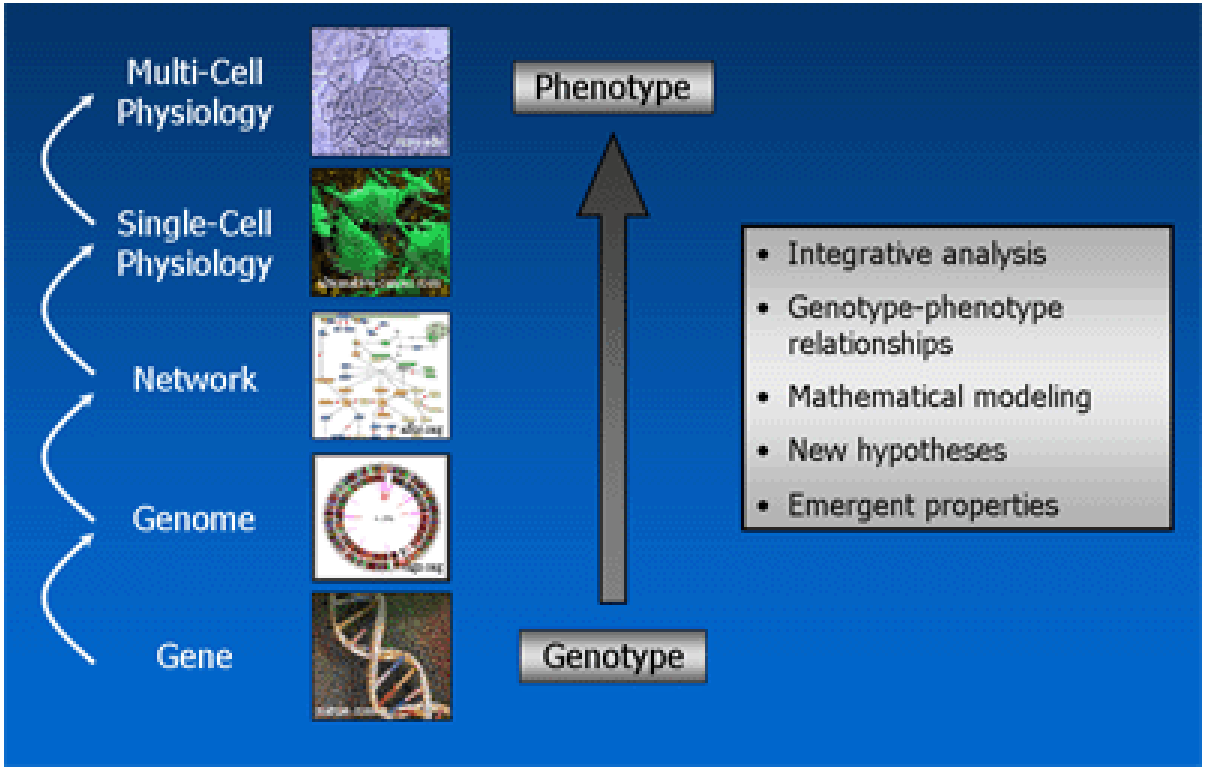
Human Mutation

OFFICIAL JOURNAL HGVS HUMAN GENOME VARIATION SOCIETY www.hgvs.org

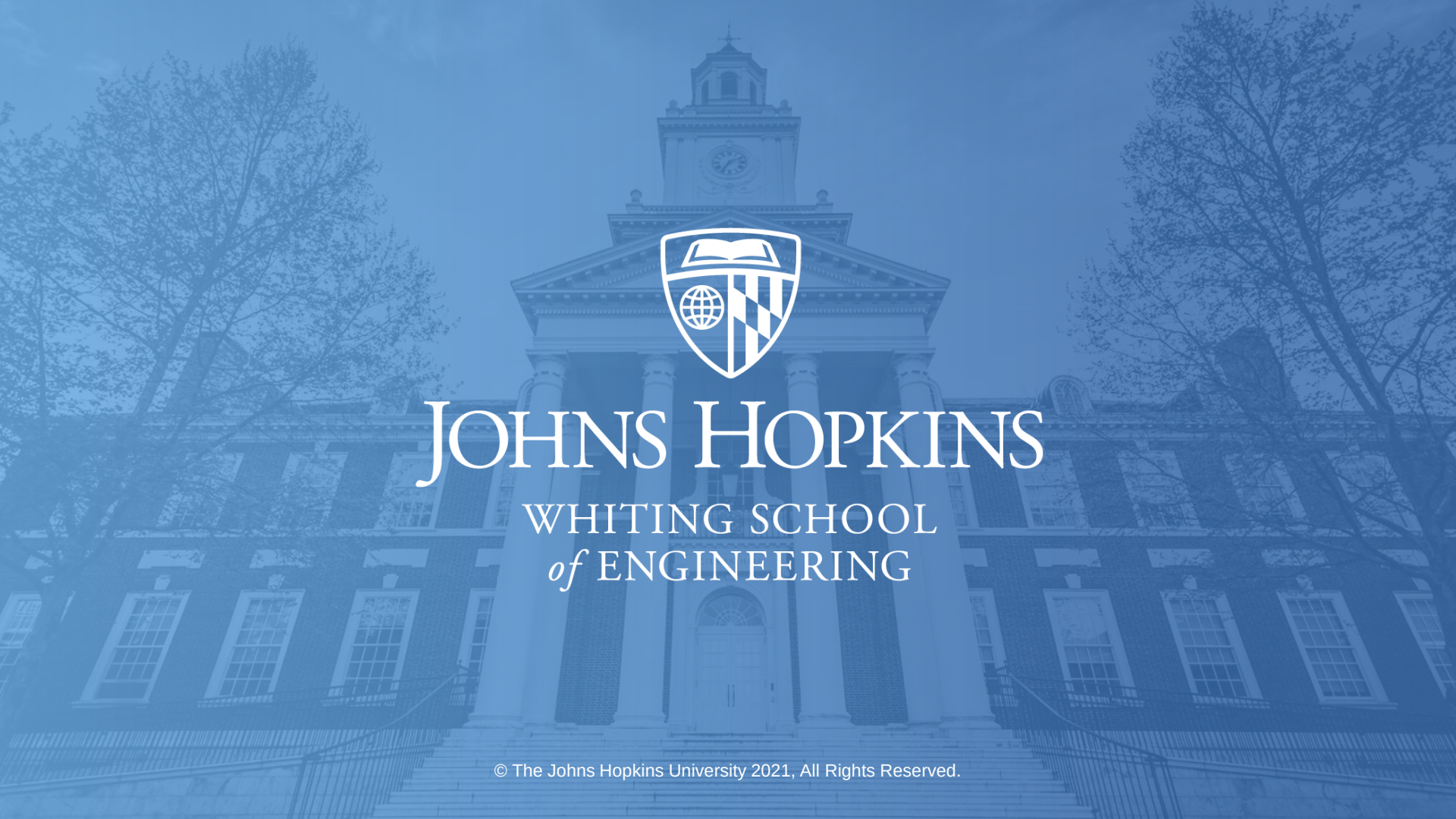
Getting Ready for the Human Phenome Project: The 2012 Forum of the Human Variome Project

Global Variome
Zhao et al 2012
UC SD News
Physiome Project

Systems biology



http://bme.virginia.edu/csbl/about.php



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