SIDNEY KIMMEL CANCER CENTER

Other Services Provided by SKCC Genomics & Bioinformatics Cores

Yipeng Wang, M.D., Ph.D.

Email: ywang@skcc.org

Phone: 858-450-5990 ext. 285

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- Bioinformatics & Data Mining
- Applications of DNA Microarray

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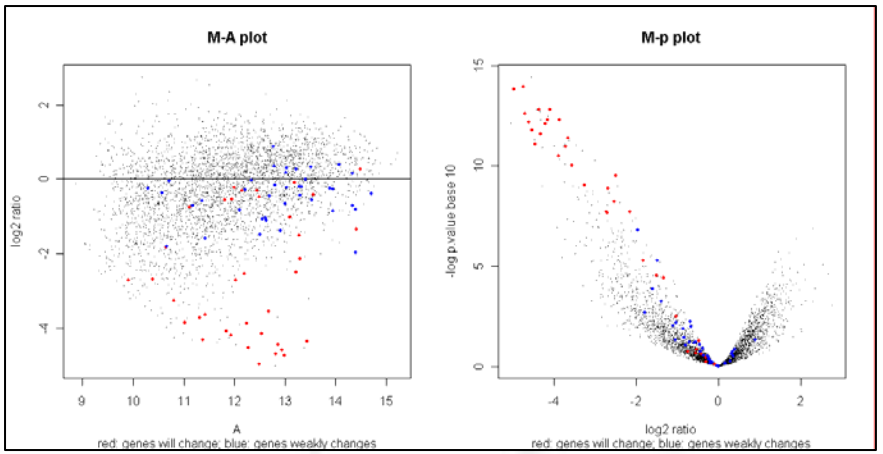
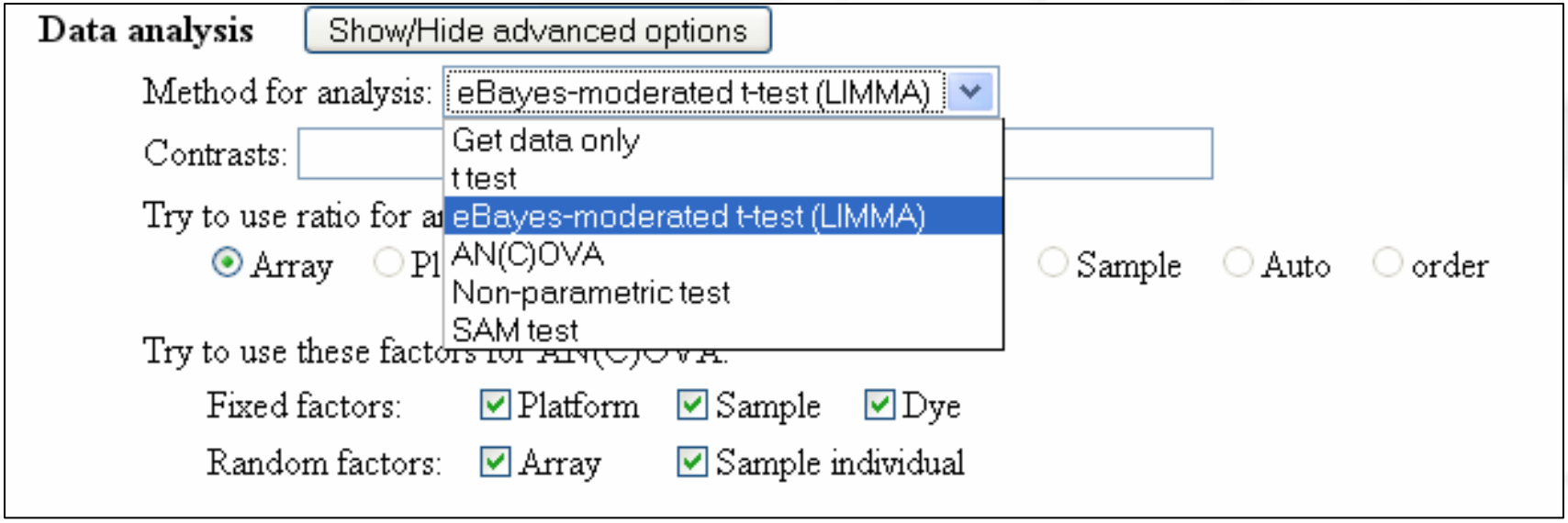
Bioinformatics & Data Mining

- Differential analysis (class classification)
  - Finding genes that are differentially expressed in tumors with different characteristics
- Clustering (Unsupervised)
  - Identification of homogeneous subtypes of cancer
- Classification (Supervised)
  - Development of a prediction rule based on gene expression
- Pathway, Gene Ontology Analysis
- DNA copy number analysis
- Custom Oligo Probe Design for DNA microarray
  - Uniform oligo probes relies on probe sequences

Differential analysis (class classification)

- WebArrayDB offers a variety of options for differential analysis.





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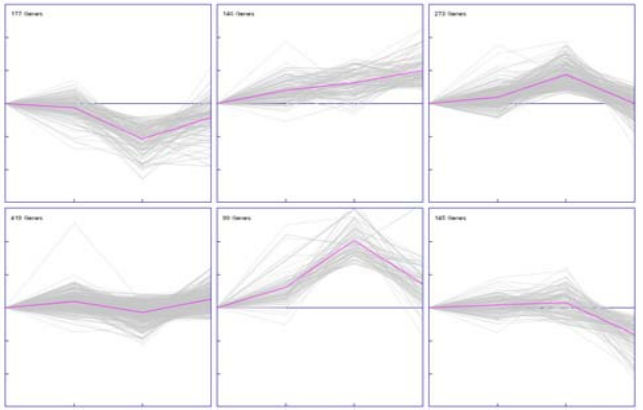
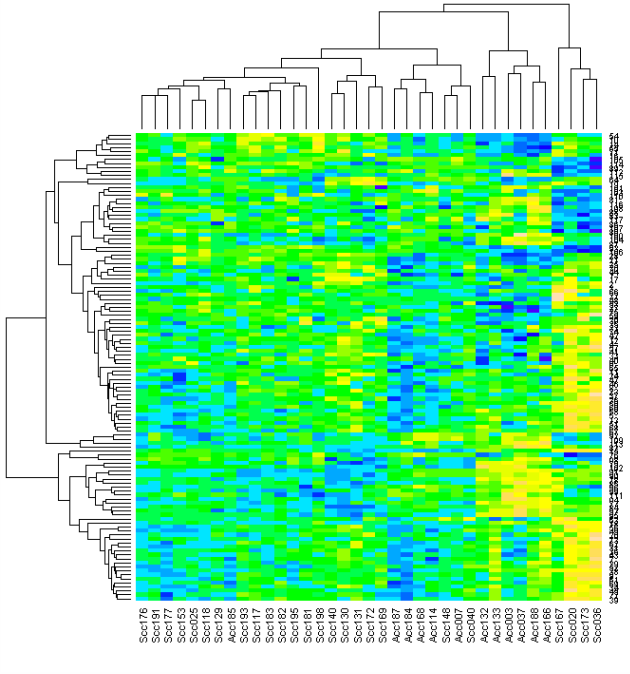
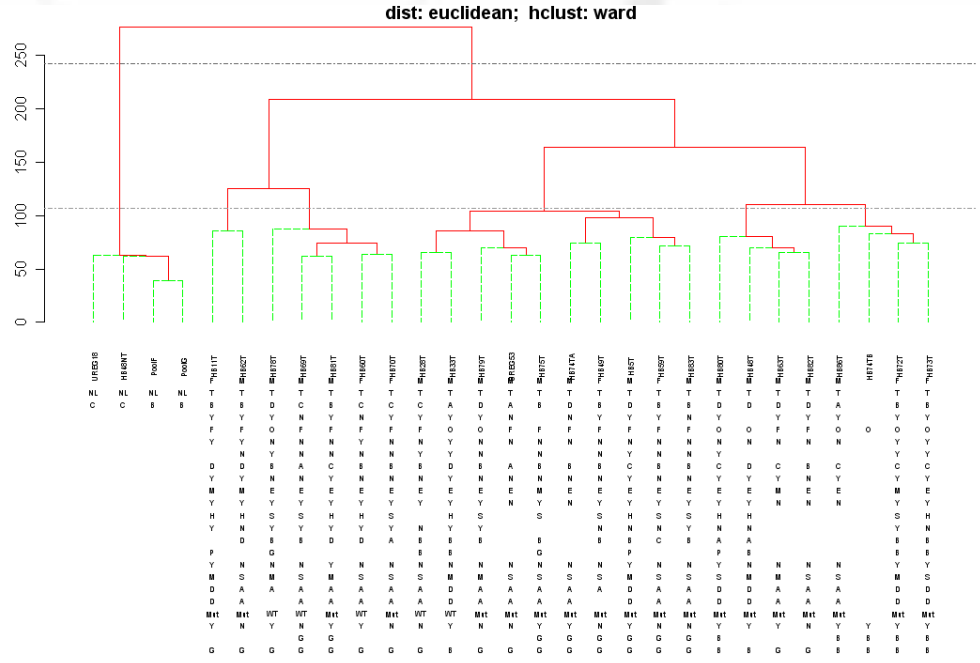
Clustering (Unsupervised)

- K-means
- Hierarchical Clustering
- SOM

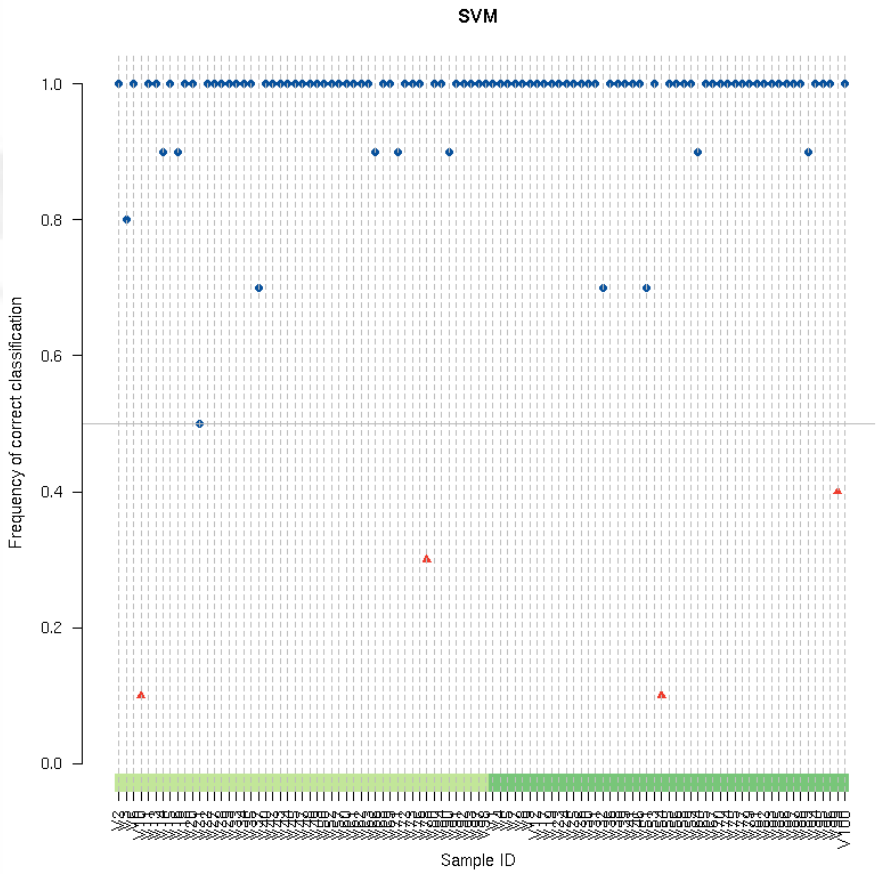






Classification (Supervised)

- PAM
- SVM
- Recursive Partitioning



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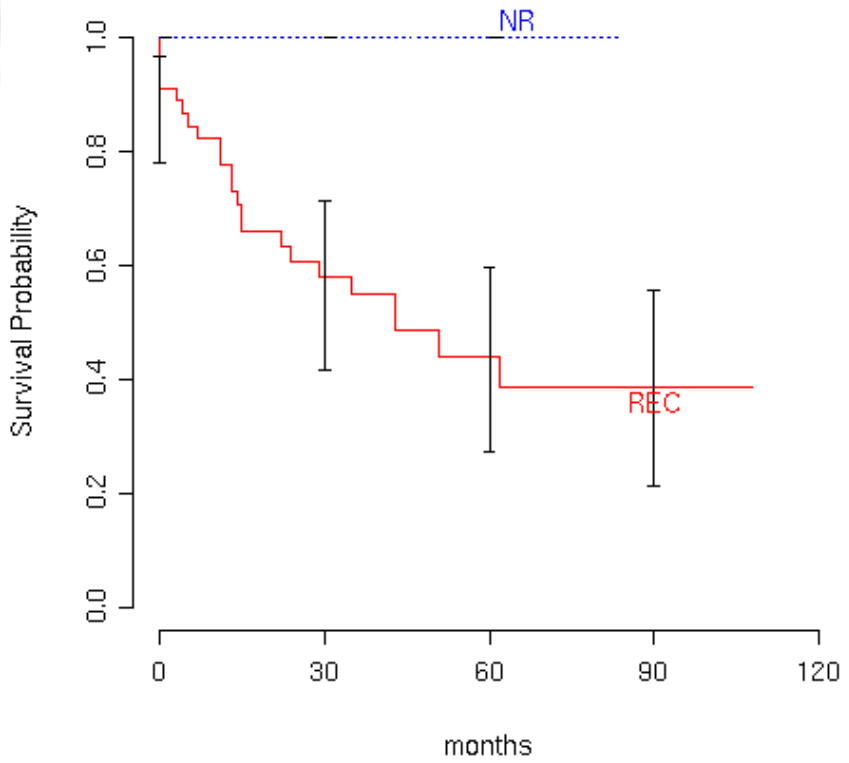
Survival Analysis



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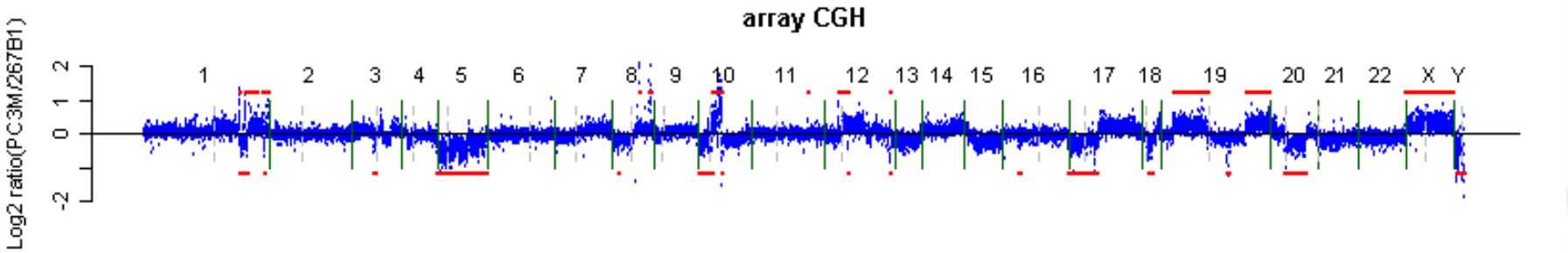
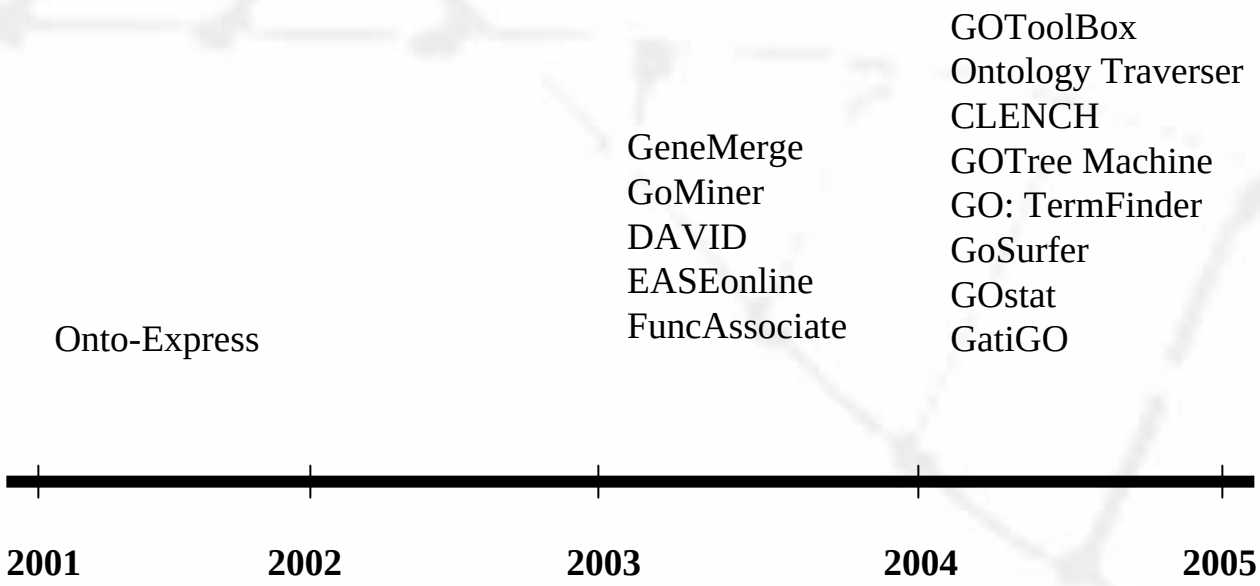
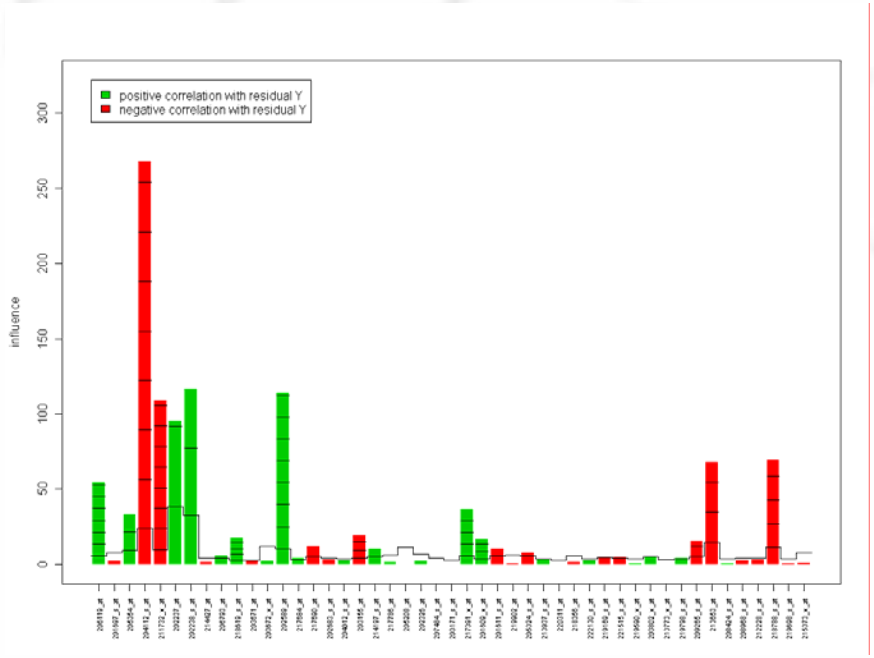
High Resolution Array-based CGH



Existing tools for ontological analysis



Gene Ontology / KEGG pathway analysis



globaltest Package

- Using this test it can be determined whether the global expression pattern of a group of genes is significantly related to some clinical outcome of interest. Groups of genes may be any size from a single gene to all genes on the chip (e.g. known pathways, specific areas of the genome or clusters from a cluster analysis).

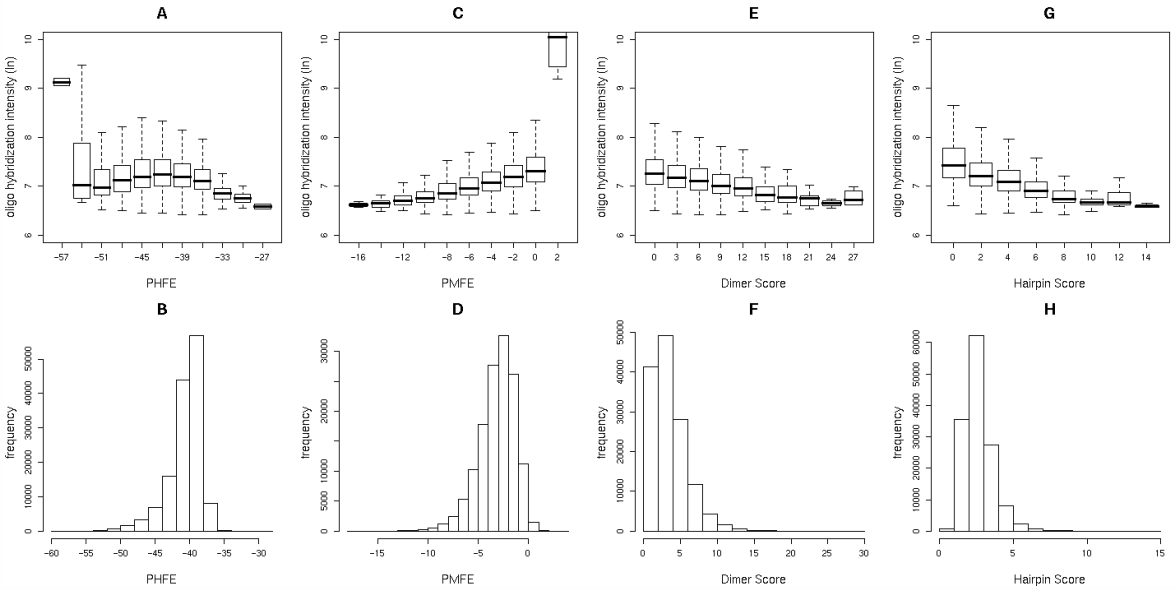
Oligo Probe Design for DNA Microarray

Probe Properties

1. Specificity
2. Sensitivity
3. Uniformity

Probe Design Parameters

1. Probe hybridization free energy
2. Positional Probe hybridization free energy
3. **Empirical Probe Binding Energy**
4. Probe minimum folding energy
5. Probe dimer score, hairpin score
6. Homology Score
7. Complexity Score



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Applications of DNA microarray

- Gene Expression
  - 3’ expression & whole transcript expression
- DNA methylation Assay
  - Whole genome DNA methylation analysis
- Chip-on-Chip
  - Identification of transcription factor binding site in whole genome scale
- Nascent RNA Expression Profiling
  - Identification of nascent RNA
- miRNA Expression Profiling
  - miRNA profiling using miRNA microarray

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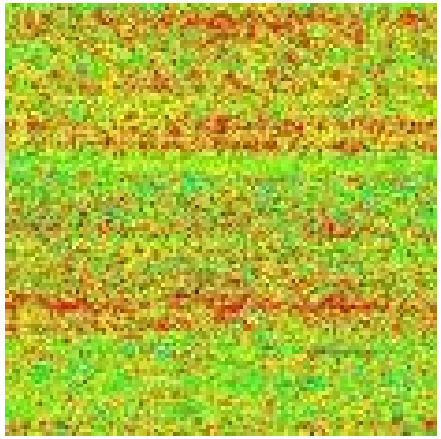
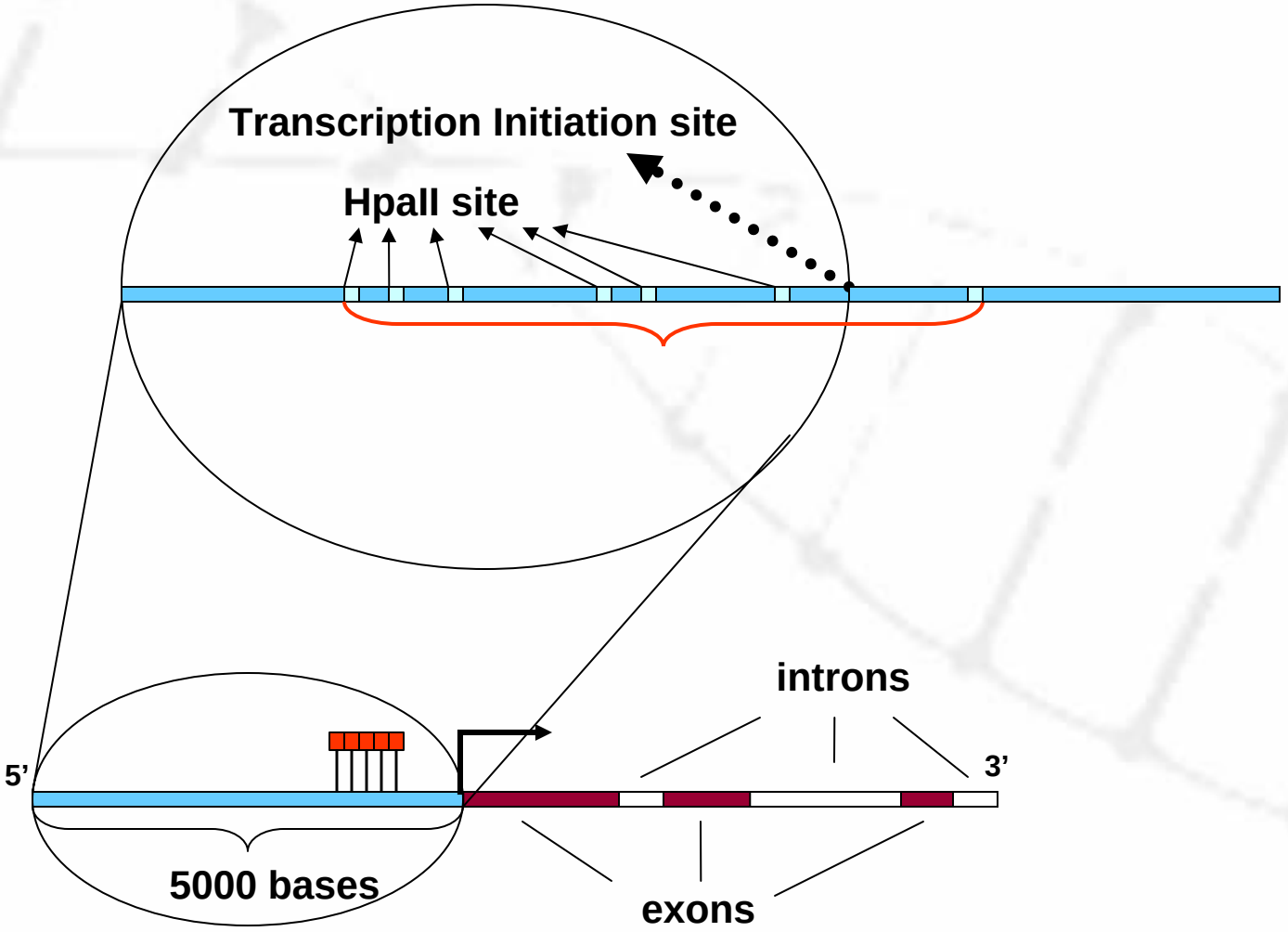
Gene Expression Profiling

- 3’ expression profiling
- Whole transcript expression profiling



Whole Genome DNA methylation Assay

Design of human promoter array



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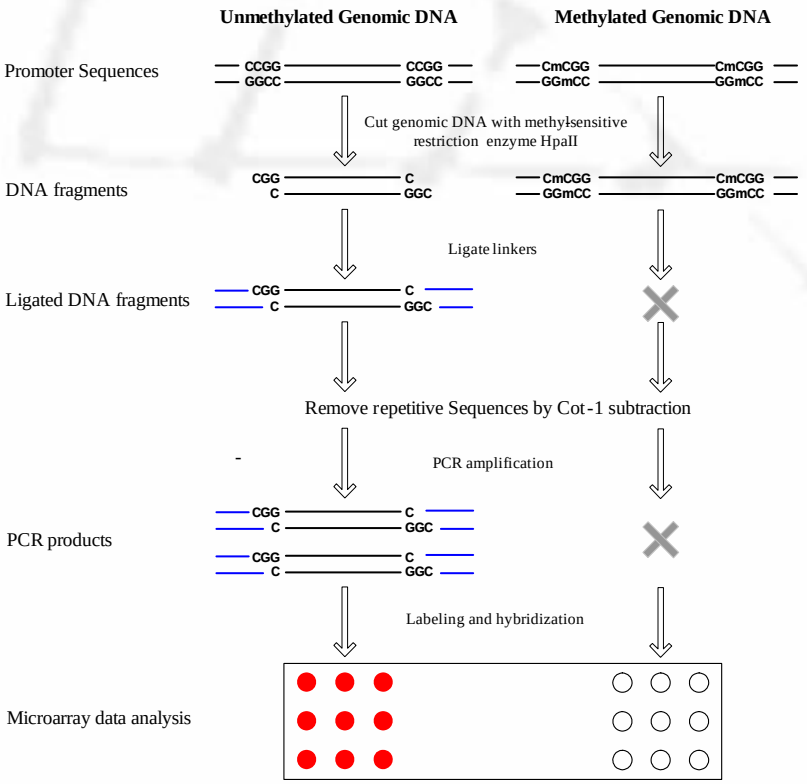
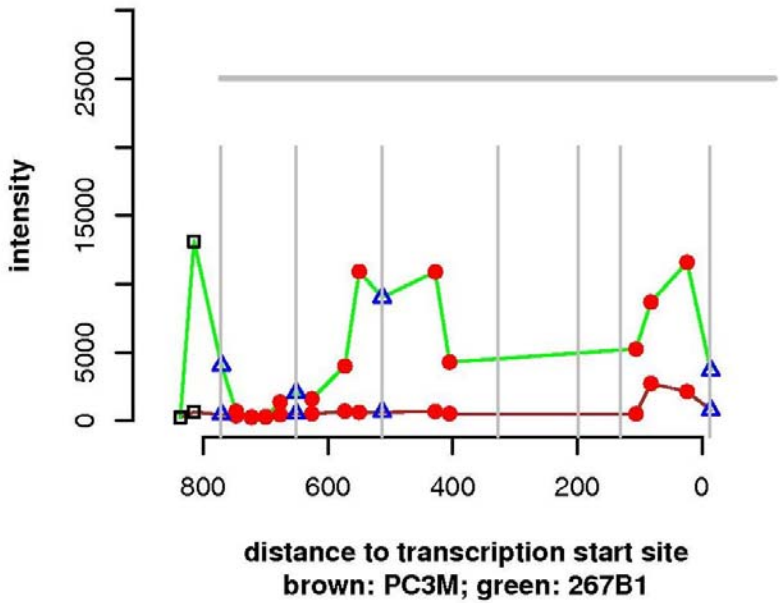
DNA Methylation Assay Schema

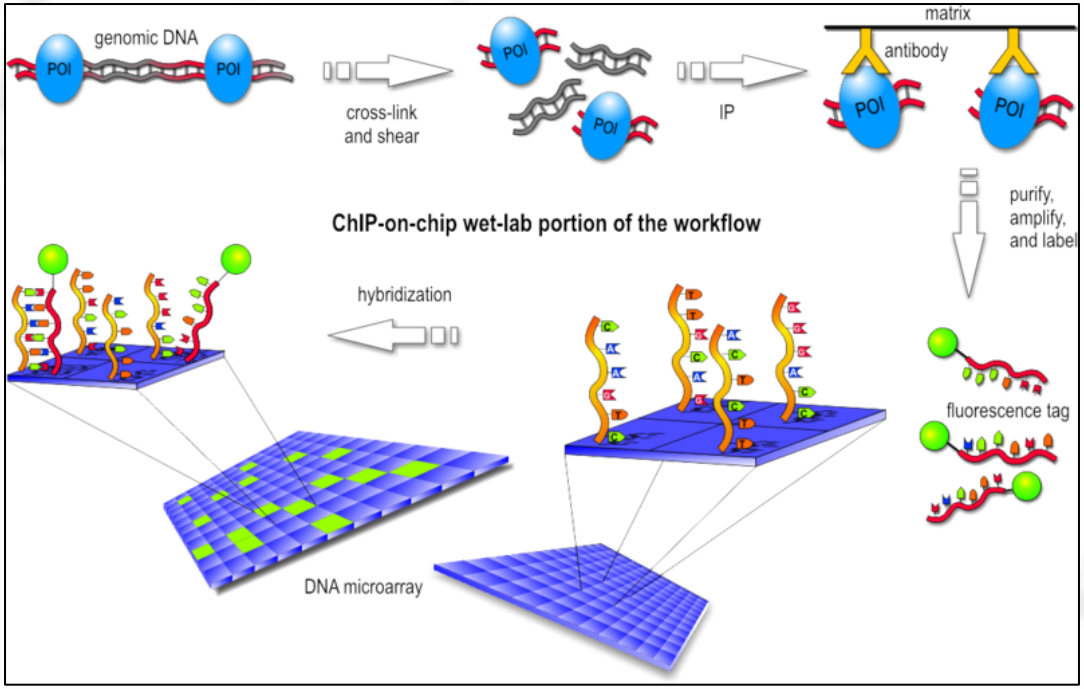


Example: C14orf39 Promoter

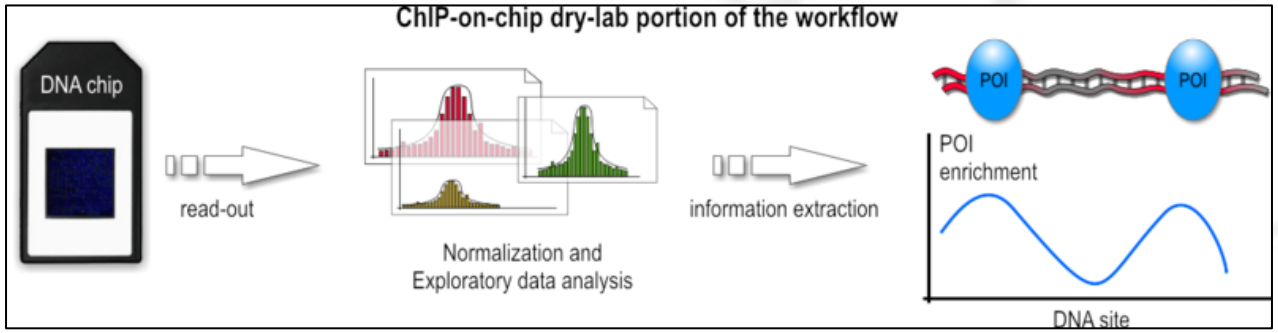


Chip-on-Chip

- **Discovery of transcription factor binding sites in promoter region.**



Publications in *Science*, *Molecular Cell* and *Blood* …



Images from Wikipedia

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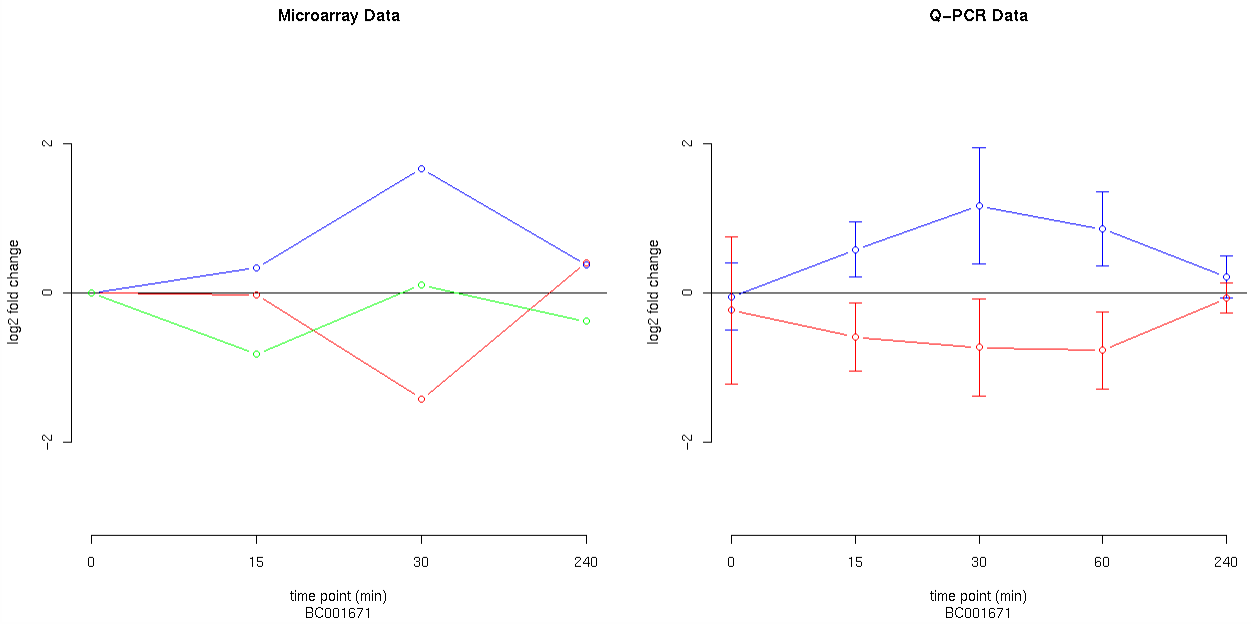
Nascent RNA Expression Profiling

- Intron Oligo Microarray
- RAP-PCR based amplification

Red: Introns

Blue: Exons

Green: Affy Probes



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miRNA Expression Profiling

- In-house miRNA microarrary
- In developing stage