The Bioconductor Project

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19-21 January, 2011

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Bioconductor: Analysis and Comprehension of High Throughput Genetic Data

Goal Help biologists understand their data

- - High-throughput sequencing
- - Code reuse statistics, visualization, domain-specific applications, e.g., *limma*
 - Interoperability

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Reproducible – scripts, vignettes, packages

Success > 400 packages; very active mailing list; annual conferences (BioC2011, Seattle, July 27-29); courses;

The Bioconductor Web Site

- Finding and installing packages
- Work flows
- ▶ Finding help in and outside *R*
- ► The *Bioconductor* release schedule

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- Developer support
- Courses and conferences

Work Flow: Expression Microarrays

Prior to analysis

- ► Biological experimental design treatments, replication, etc.
- Microarray preparation especially two-channel

Analysis

- 1. Pre-processing (normalization); quality assessment; exploratory analysis
- 2. Differential expression; machine learning (clustering and classification)
- 3. Annotation
- 4. Gene set enrichment; systems biology

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http://bioconductor.org/workflows for common analyses.

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Chiaretti et al., 2005 [1]

- ▶ 128 adult patients, newly diagnosed for ALL
- B- and T-lineage; various molecular and cytological characteristics.
- HG-U95Av2
- Pre-processed (background correction, normalization, summarization into probe sets).

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The ALL dataset

```
> library(ALL); data(ALL); ALL
ExpressionSet (storageMode: lockedEnvironment)
assayData: 12625 features, 128 samples
  element names: exprs
protocolData: none
phenoData
  sampleNames: 01005 01010 ... LAL4
    (128 total)
  varLabels: cod diagnosis ... date
    last seen (21 total)
  varMetadata: labelDescription
featureData: none
experimentData: use 'experimentData(object)'
  pubMedIds: 14684422 16243790
Annotation: hgu95av2
```

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Pre-processing affy, oligo, lumi, beadarray, limma, genefilter, ...
Machine learning MLInterfaces, CMA
Differential expression limma, ...
Gene set enrichment topGO, GOstats, GSEABase, ...
Annotation AnnotationDbi, 'chip', 'org' and BSgenome packages
'Domain-specific' DNAcopy, snpMatrix, ...

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Lab activity

Goal: learn to work with S4 classes, especially ExpressionSet

- 1. Load and explore ALL object, including finding help on S4 objects.
- Extract mol.biol phenoData, subset samples to include only BCR/ABL or NEG.

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3. Filter (remove) probes without gene-level annotation

References

S. Chiaretti, X. Li, R. Gentleman, A. Vitale, K. S. Wang, F. Mandelli, R. Foa, and J. Ritz. Gene expression profiles of B-lineage adult acute lymphocytic leukemia reveal genetic patterns that identify lineage derivation and distinct mechanisms of transformation. Clin. Cancer Res., 11:7209-7219, Oct 2005.