An Introduction to Microarrays

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Microarrays

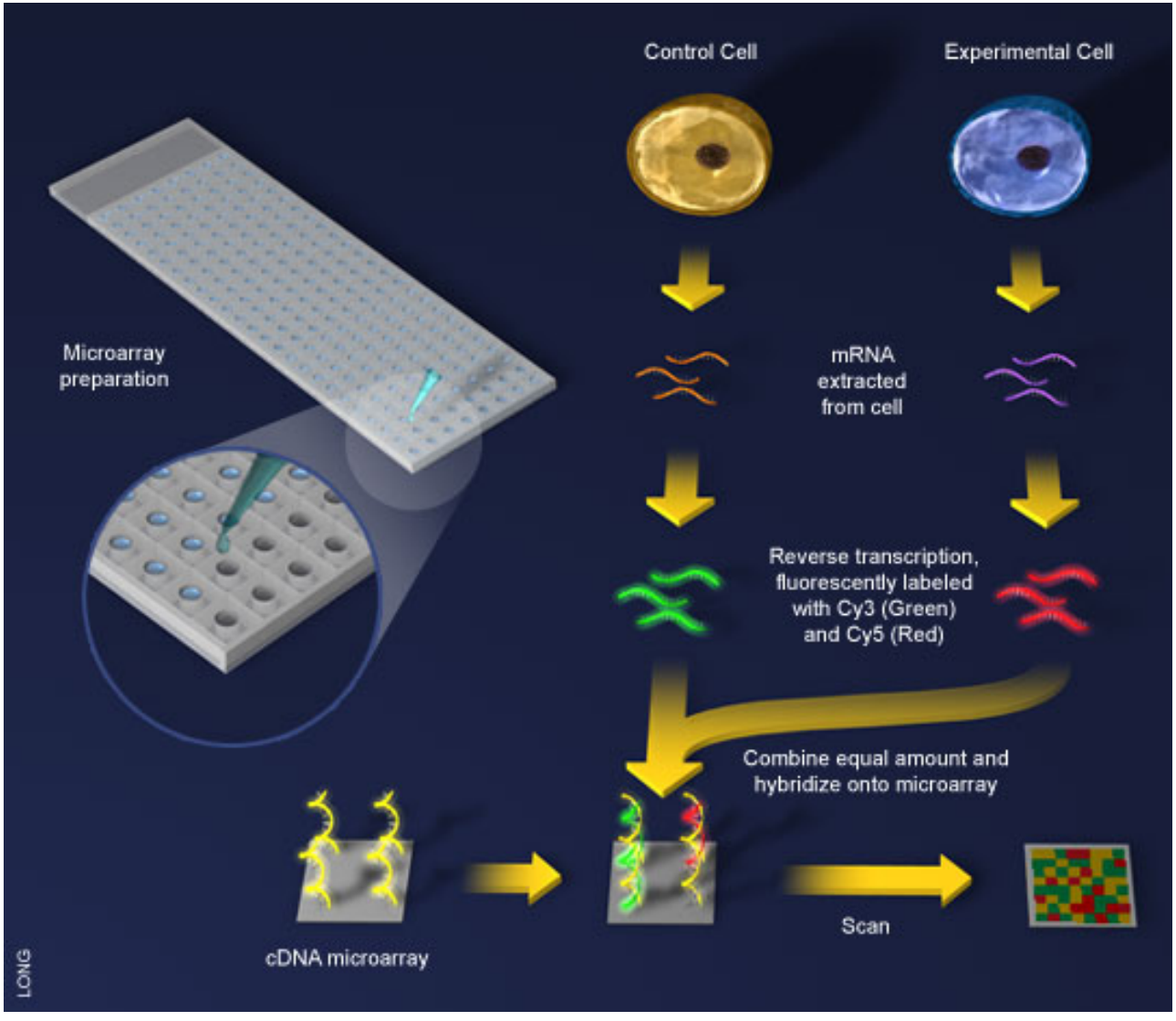
Microarrays are physical platforms that have nucleotide sequences bound to their surface.

Since nucleotide sequences hybridize to their complements we can use these bound sequences to fish out their complements from a mixture of nucleotide sequences.

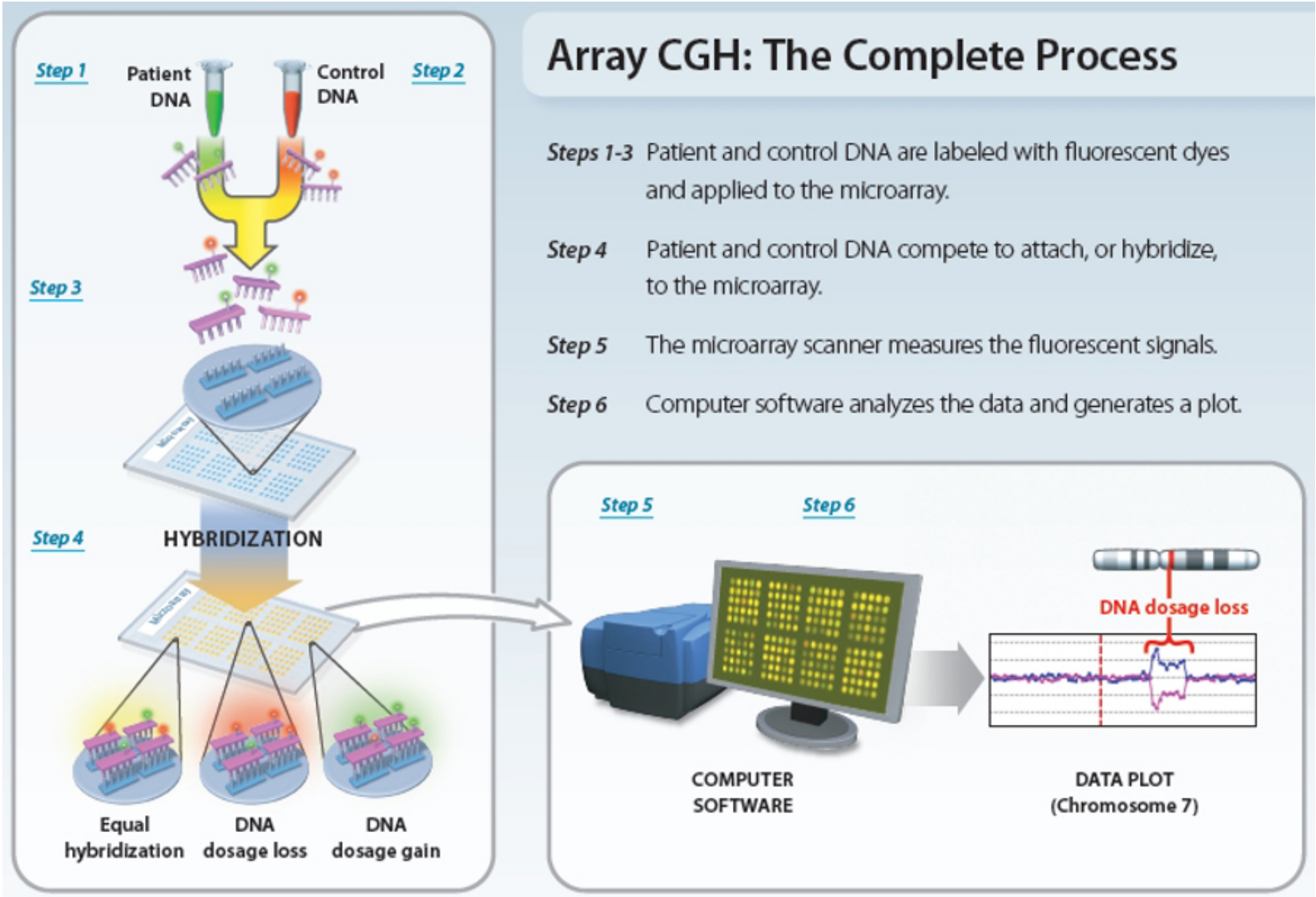
Microarrays can be used for many purposes including

- genotyping
- measuring gene expression
- determining DNA copy number
- determining transcription factor binding sites

One Type of Microarray Experimental Procedure

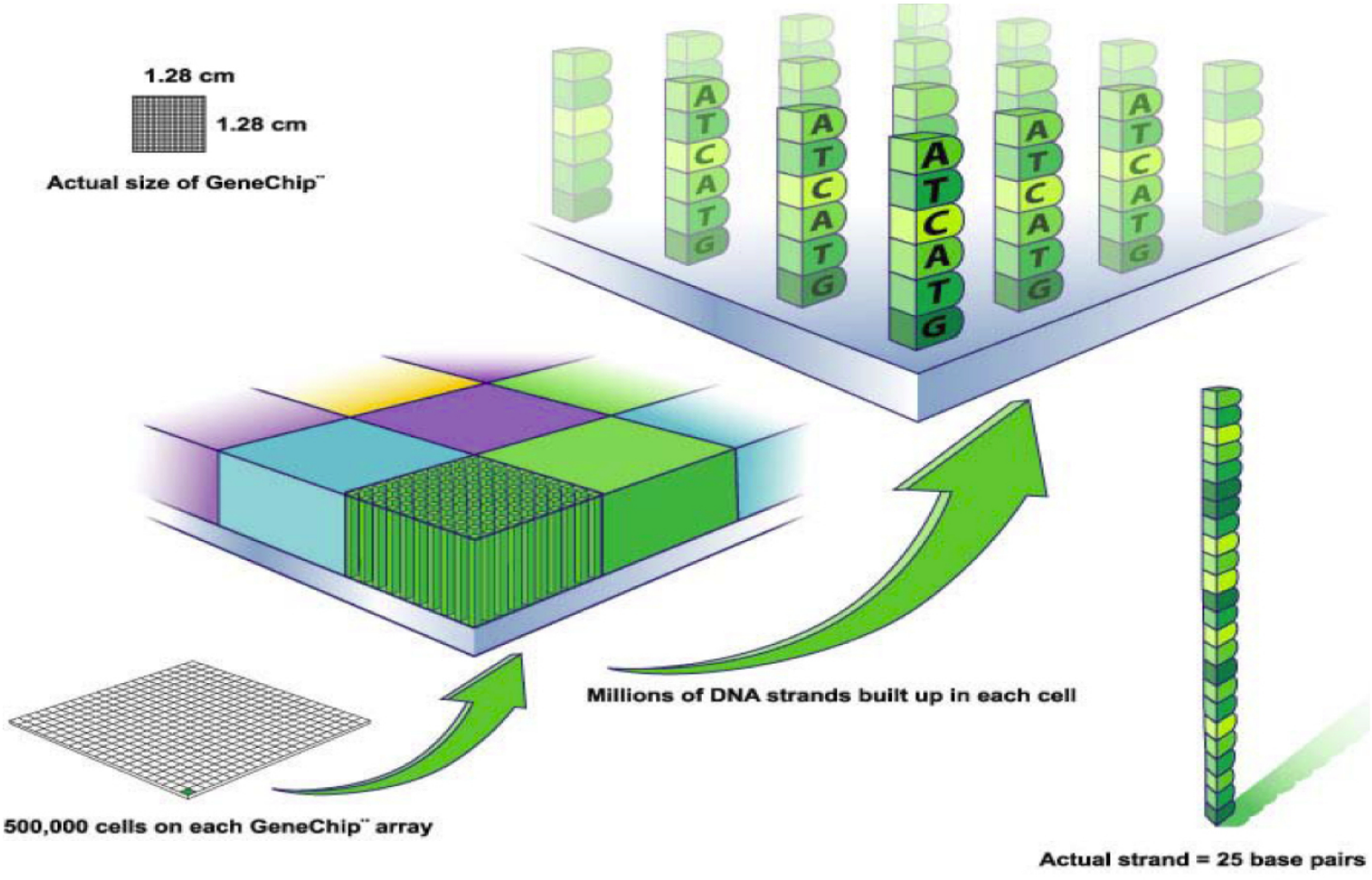


Array-comparative genomic hybridization (aCGH)



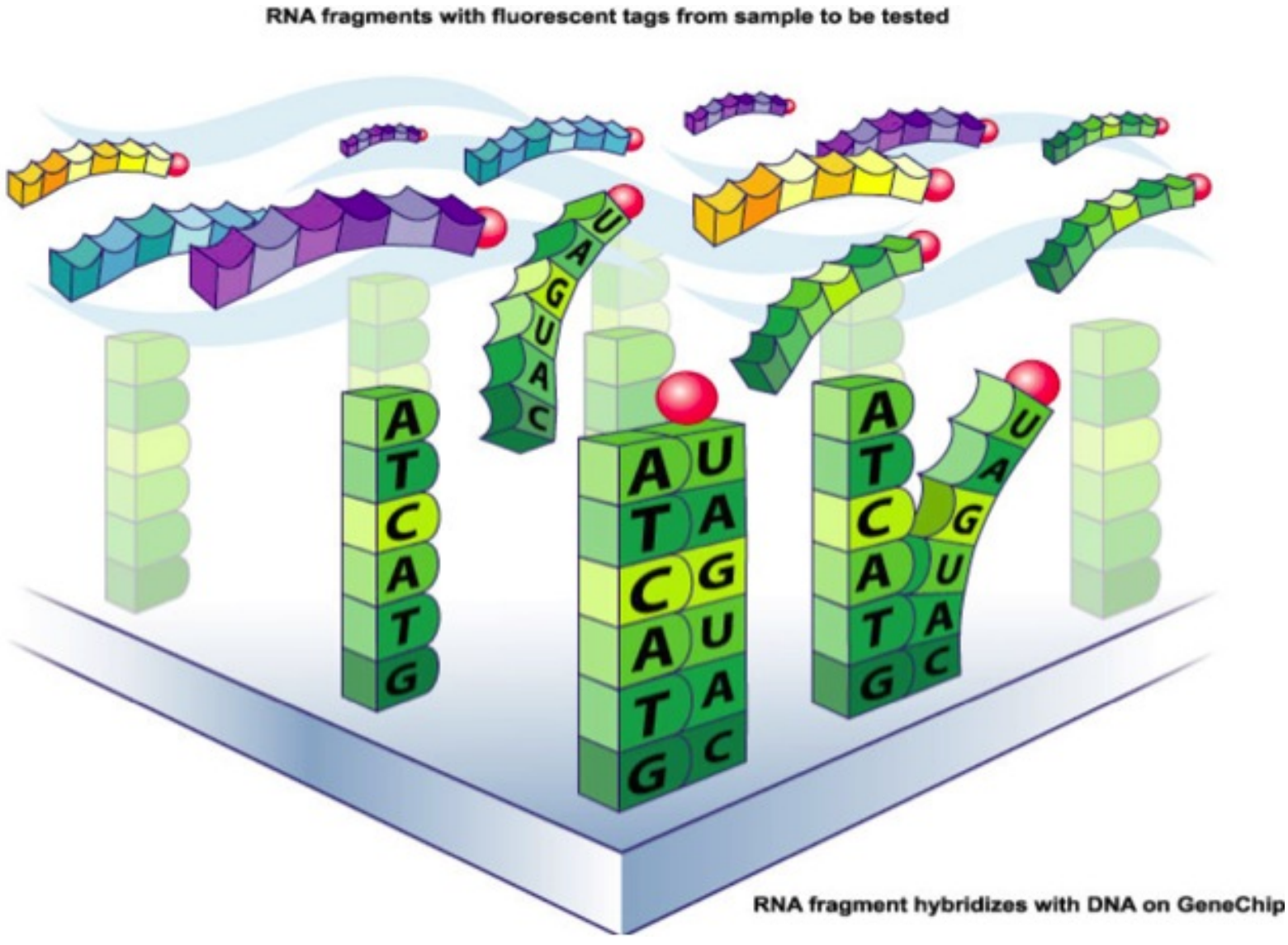
Nature Education1(1). Microarray-based Comparative Genomic Hybridization (aCGH)

Affymetrix GeneChip®



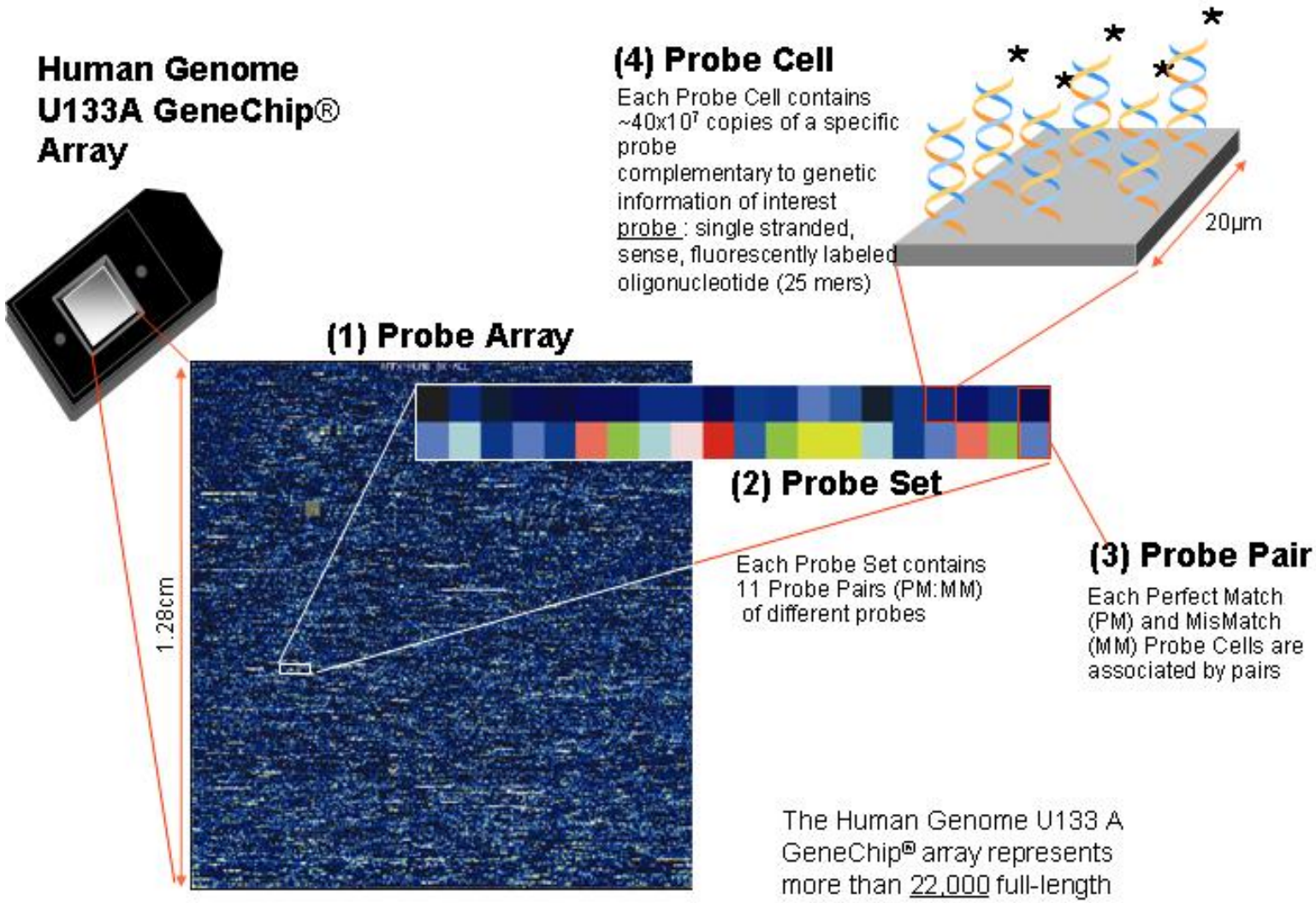
source: Affymetrix

Affymetrix GeneChip®



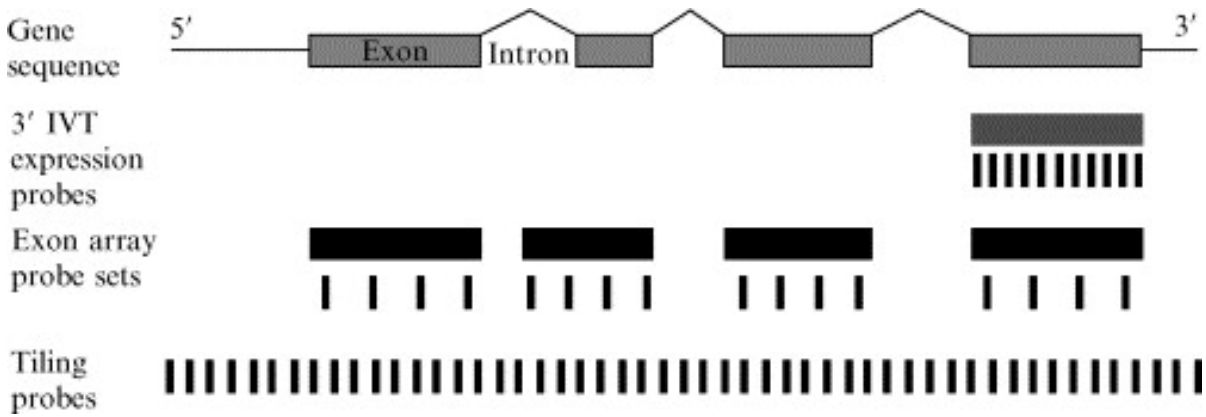
source: Affymetrix

Affymetrix GeneChip®



Probe Set

A probe set is a collection of probes designed to interrogate a given sequence.



PM versus MM

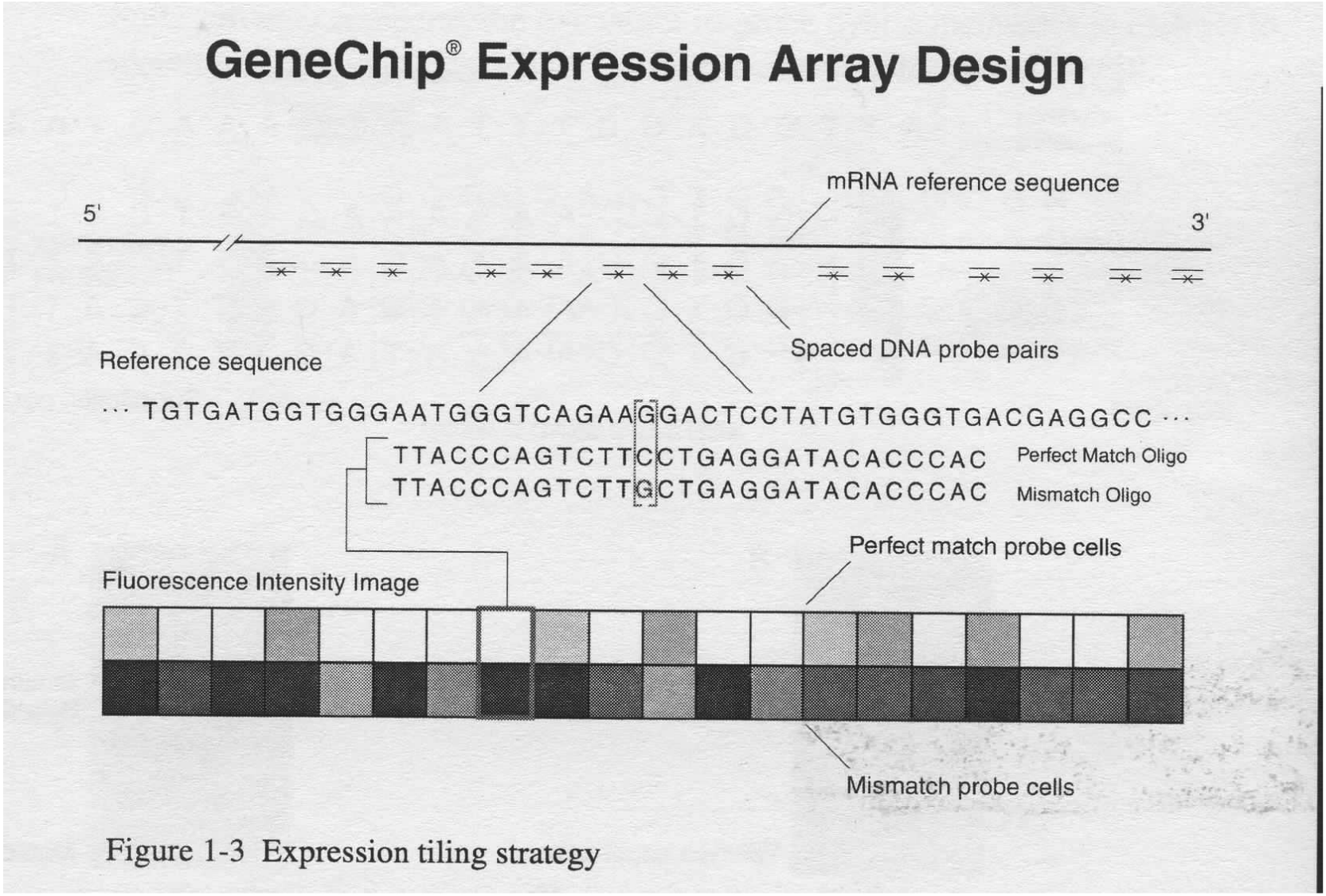
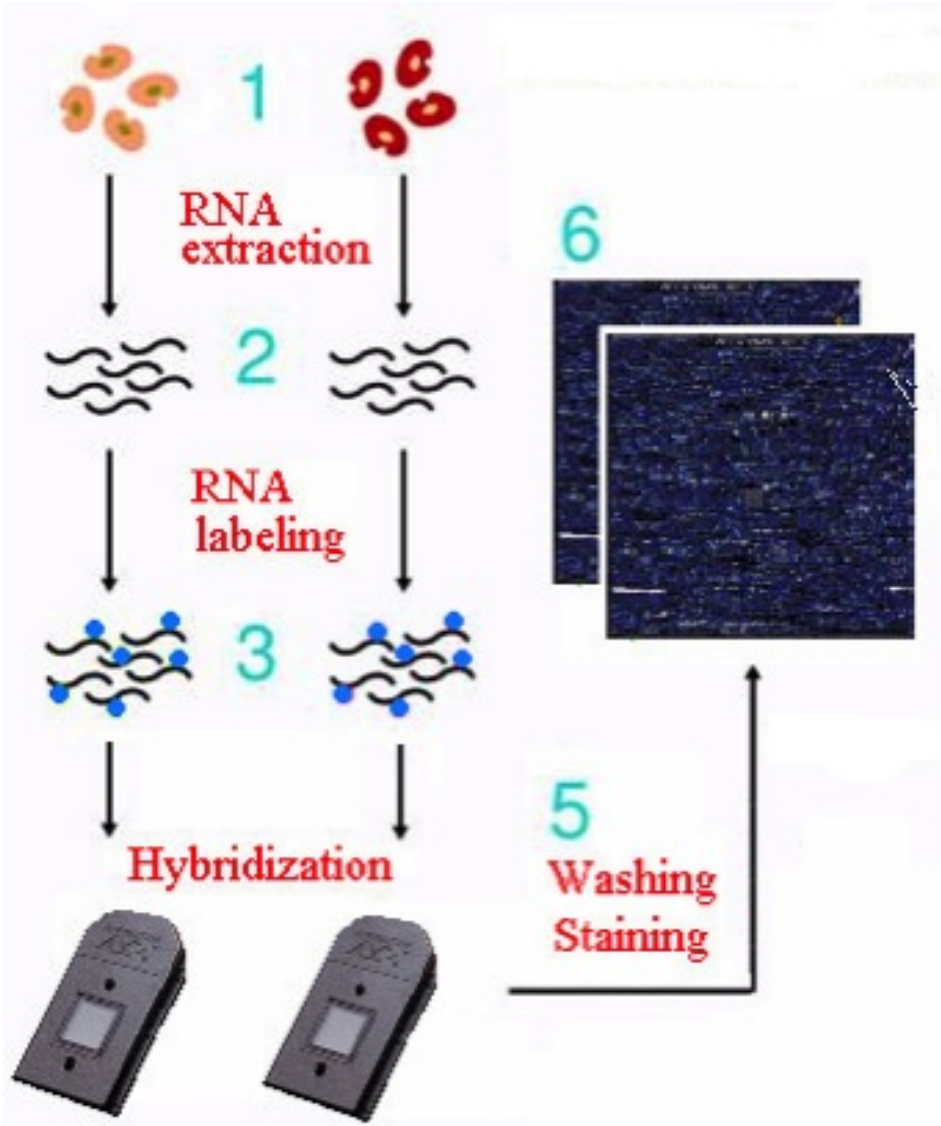
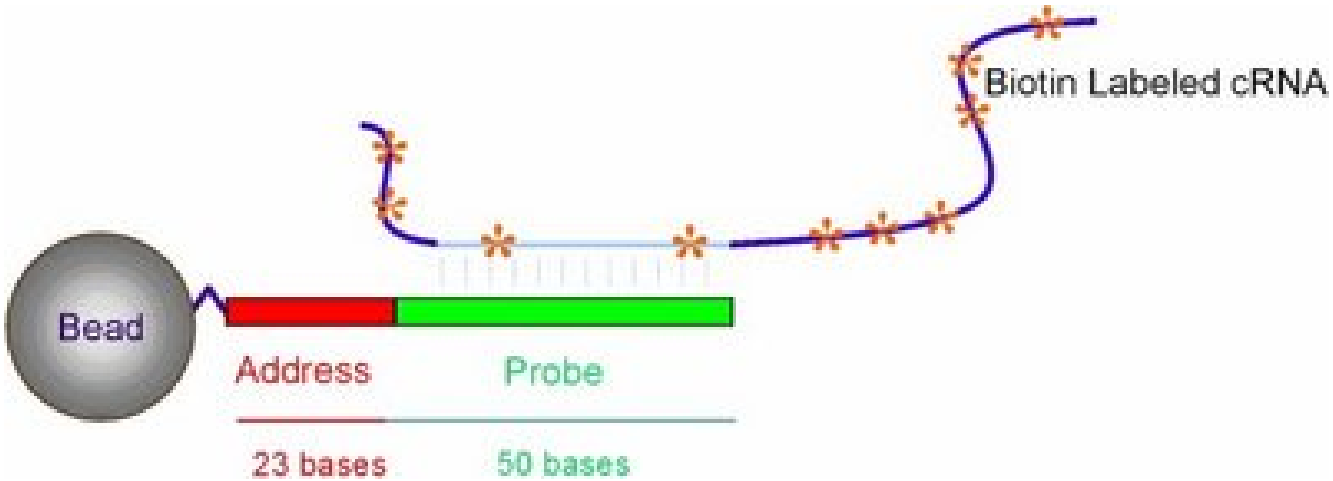


Figure 1-3 Expression tiling strategy

Affymetrix GeneChip® Experiment Protocol



Illumina BeadArrays



- Each silica bead is 3 μ in diameter
- 700,000 copies of the same probe sequence attached to each bead
- May have more than one bead for a particular gene

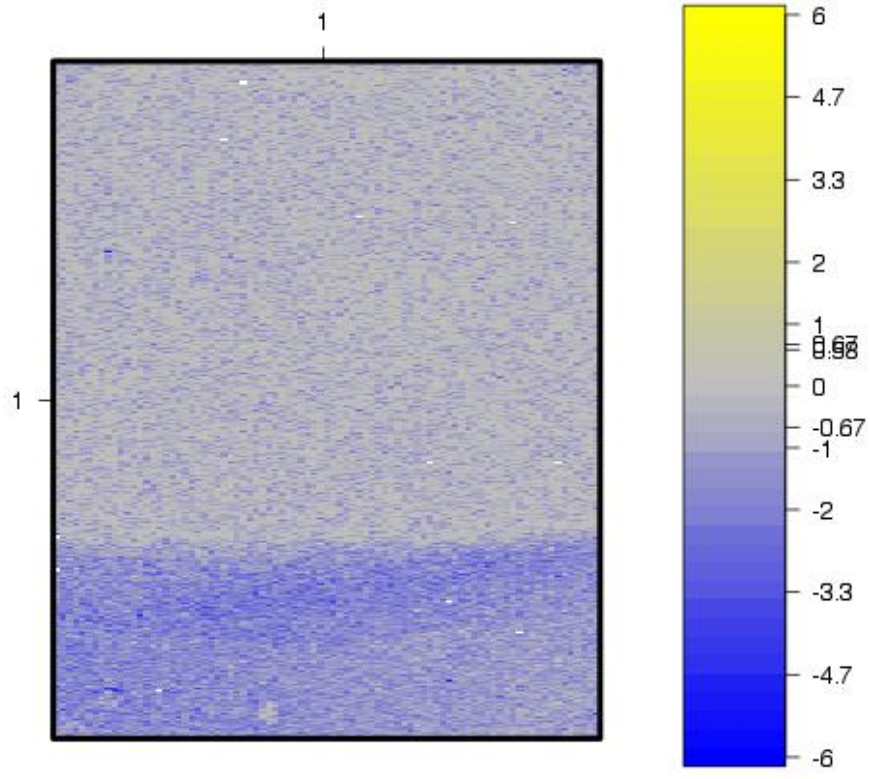
Illumina BeadArrays

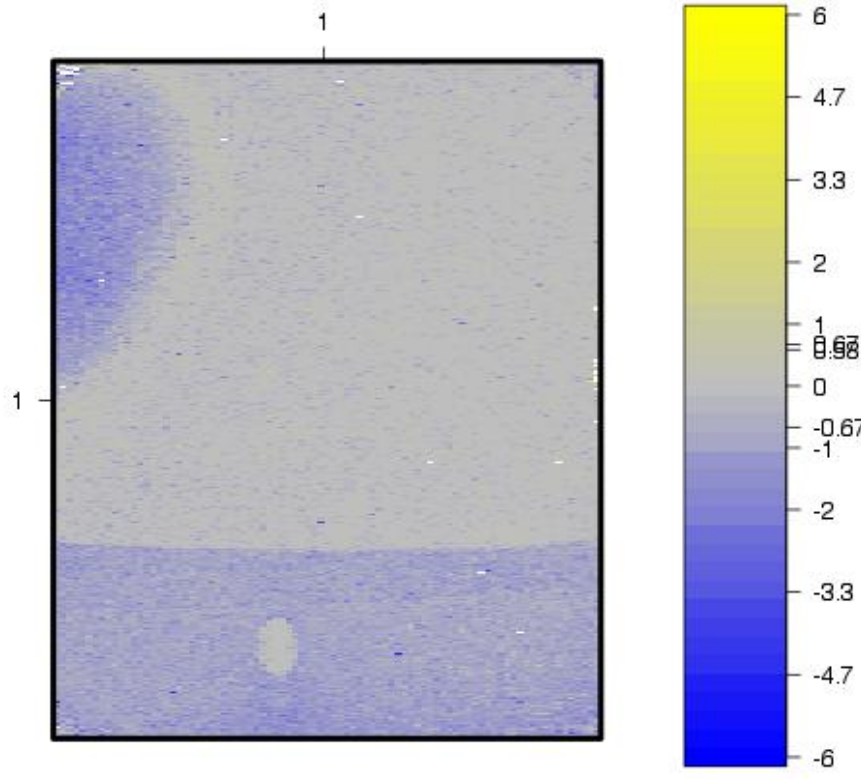
- RefSeq BeadChip (left) 8 arrays per chip, 1 strip= 1 array
- Whole Genome (right) 6 arrays per chip, 2 strip= 1 array

Commons Issues

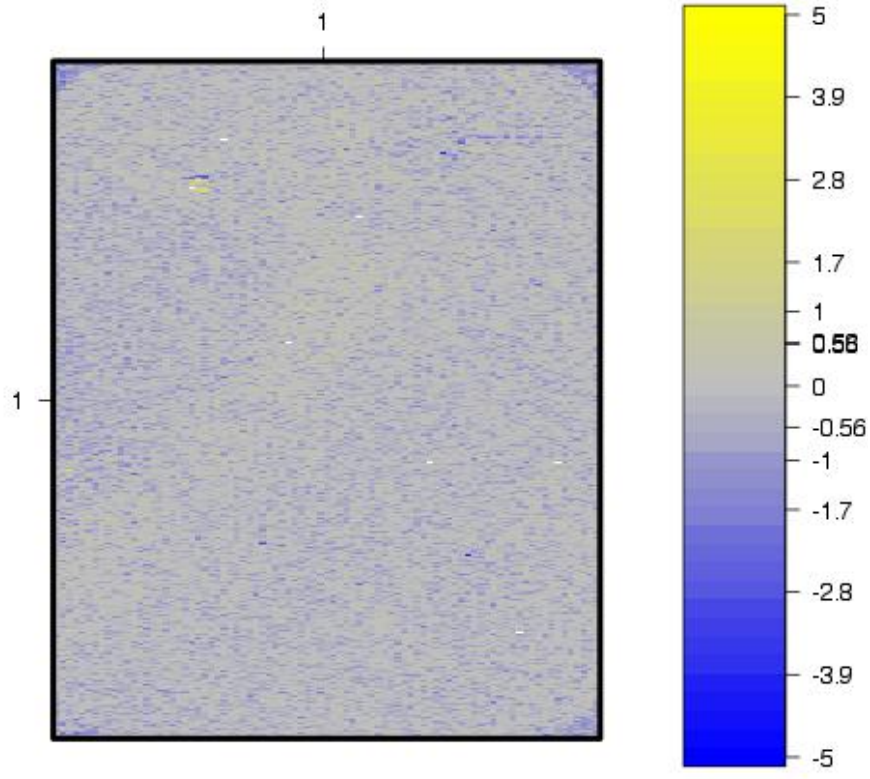
- Background: print-tip, plate, print-order, spatial effects
- Between arrays: batches, plates, cross platform comparison, experiment protocols
- Within arrays: background noise, intensity dependent effects

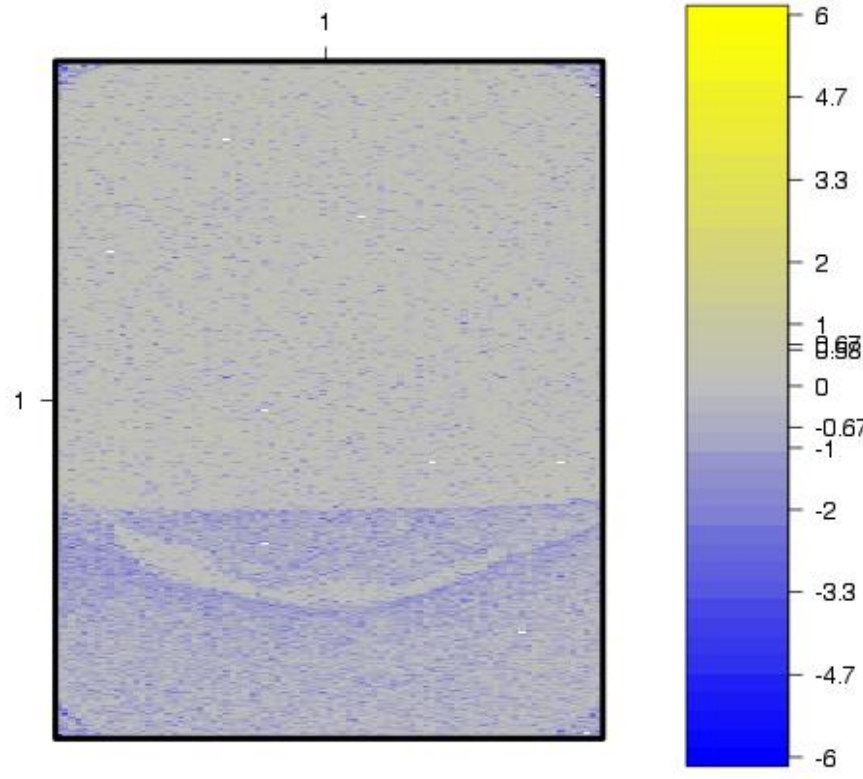
Spatial Effect

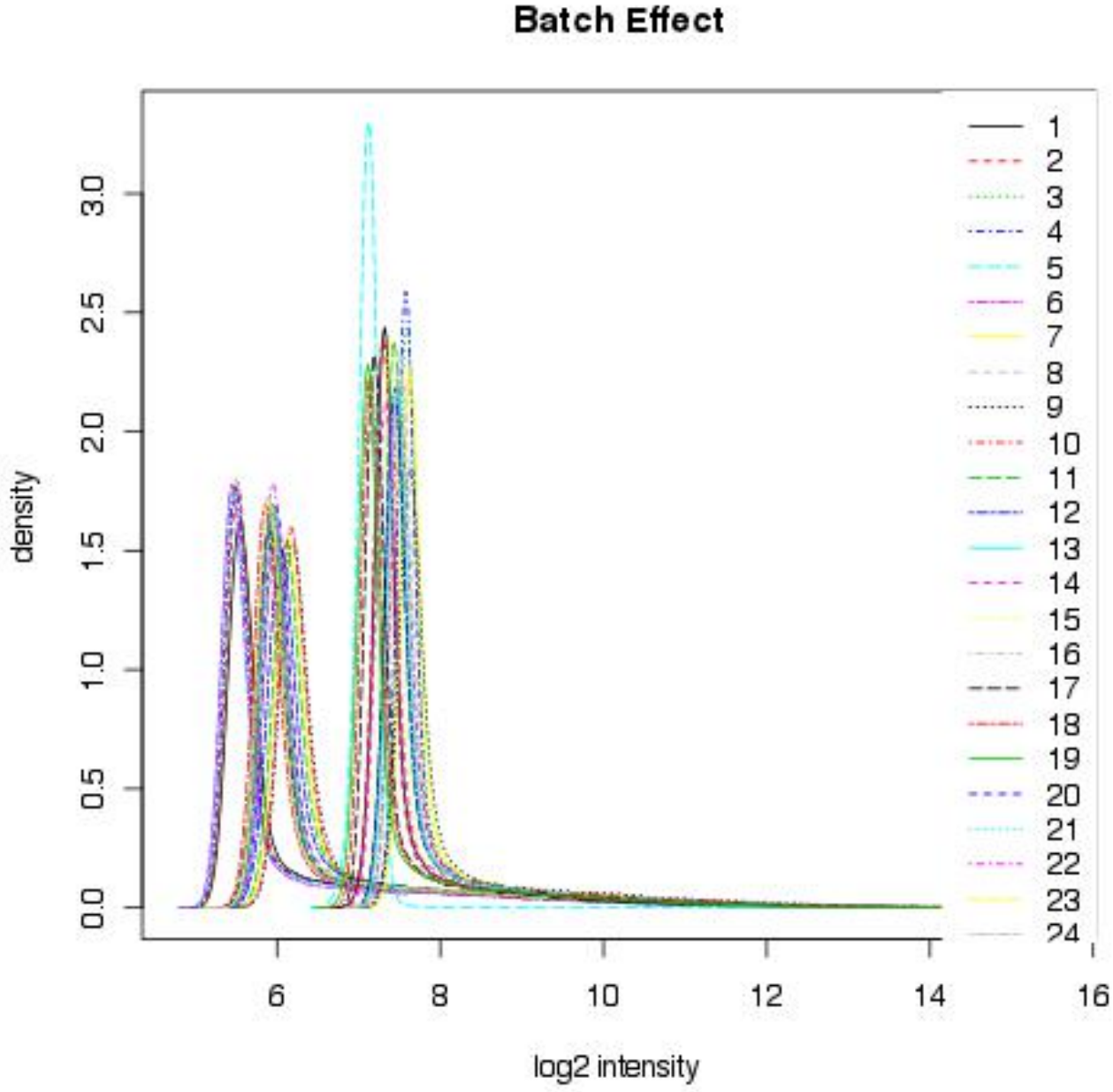




Spatial Effect






Batch Effect
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2.0
2.5
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log2 intensity
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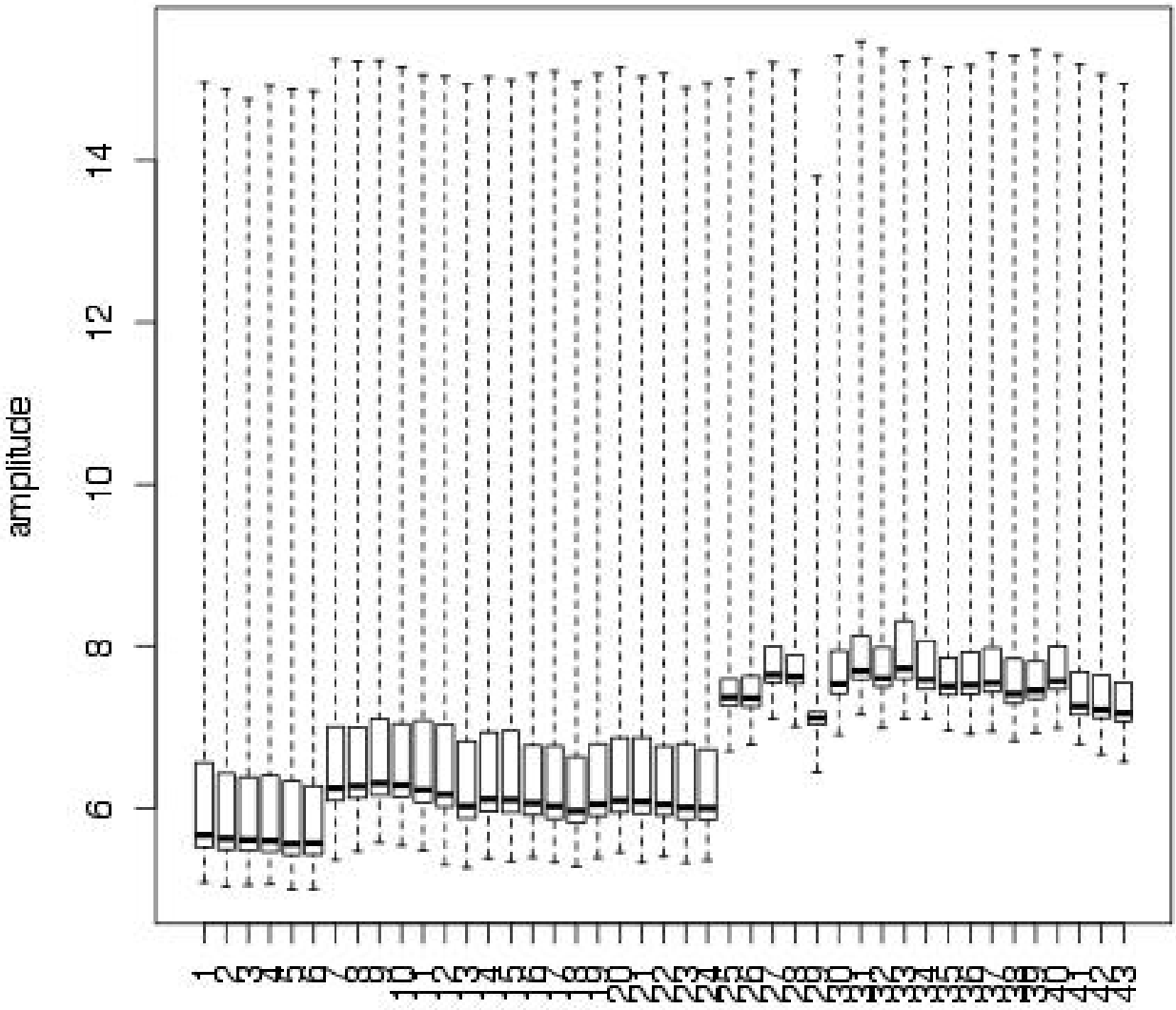
Batch Effect



ChIP-chip

Chromatin immunoprecipitation ("ChIP") with microarray technology ("chip")