Introduction to Technology

Microarrays

Terminology

- Microarray, array, or chip
- Hybridization
- Probes
- Features
- Target
- Scanner
- Intensities

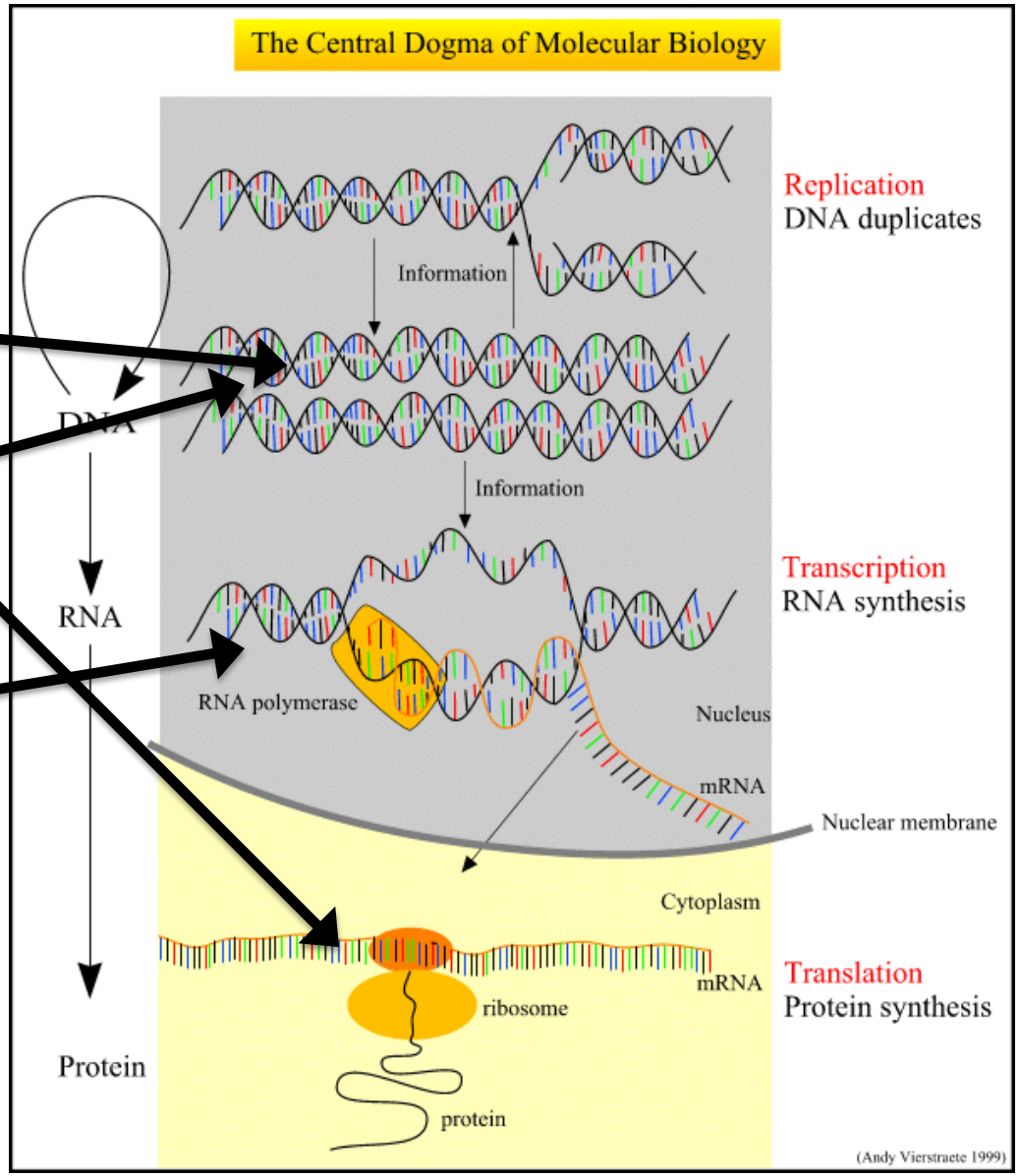
What Do They Measure?

Microarrays

SNP Chip

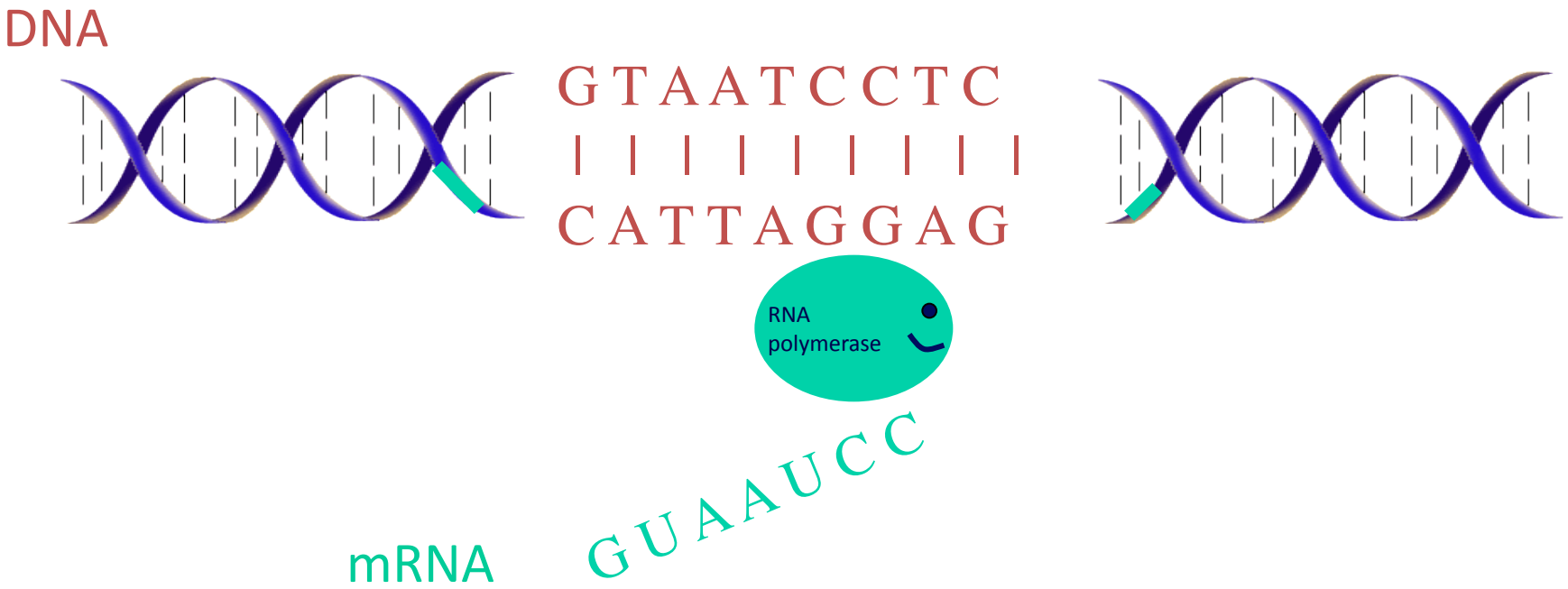
ChIP-Chip

Gene Expression Arrays
Exon Arrays



For historical reasons we will focus on gene expression

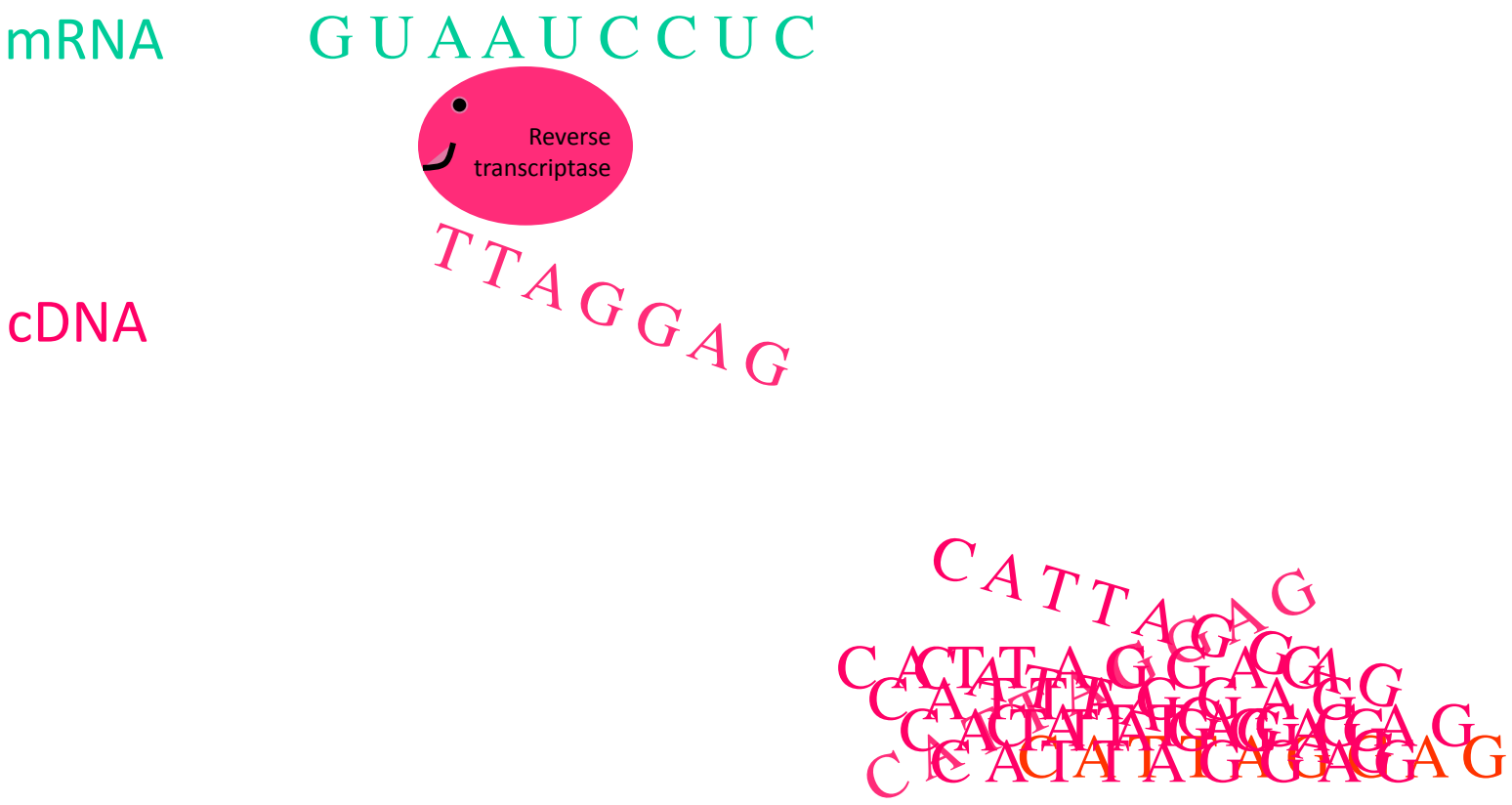
Transcription



From DNA to mRNA

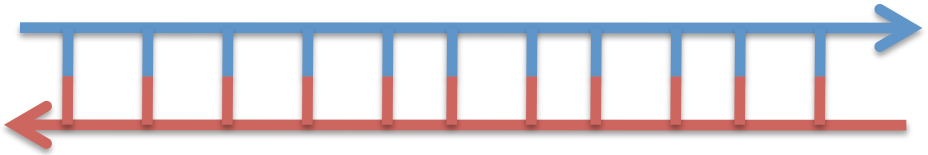
Reverse transcription

Clone cDNA strands, complementary to the mRNA



Nucleic Acid

A T G C C G T T G C A



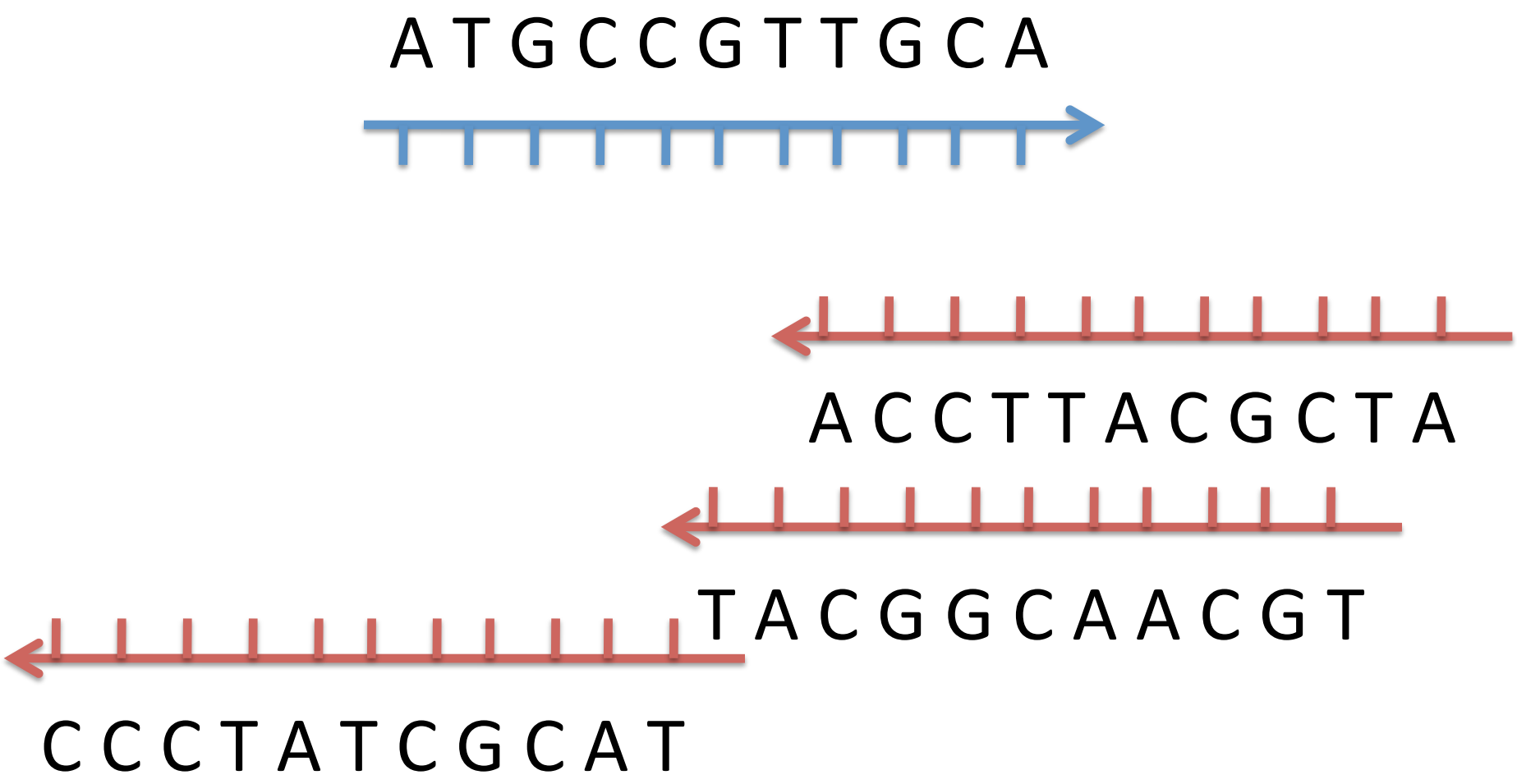
T A C G G C A A C G T

Denaturation

A T G C C G T T G C A

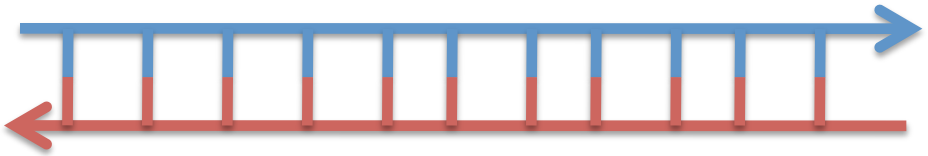
T A C G G C A A C G T

Hybridization



Hybridization

A T G C C G T T G C A



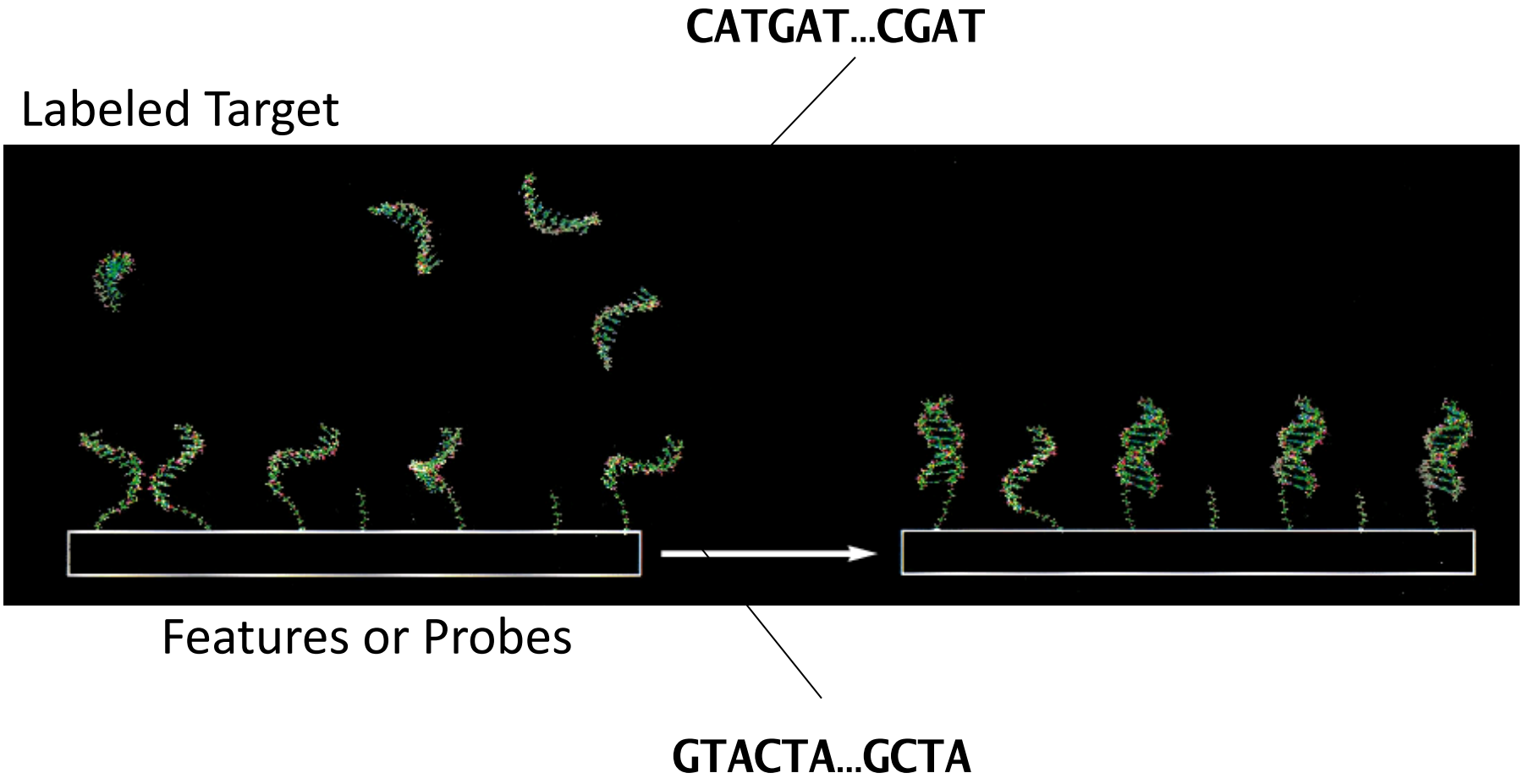
T A C G G C A A C G T

A C C T T A C G C T A

C C C T A T C G C A T

Hybridization

Hybridization



Type of platform

- Probes can be sequenced or cloned
- Features can be high-density or circles in a grid
- One or two samples hybridized to array

Platforms that dominate market

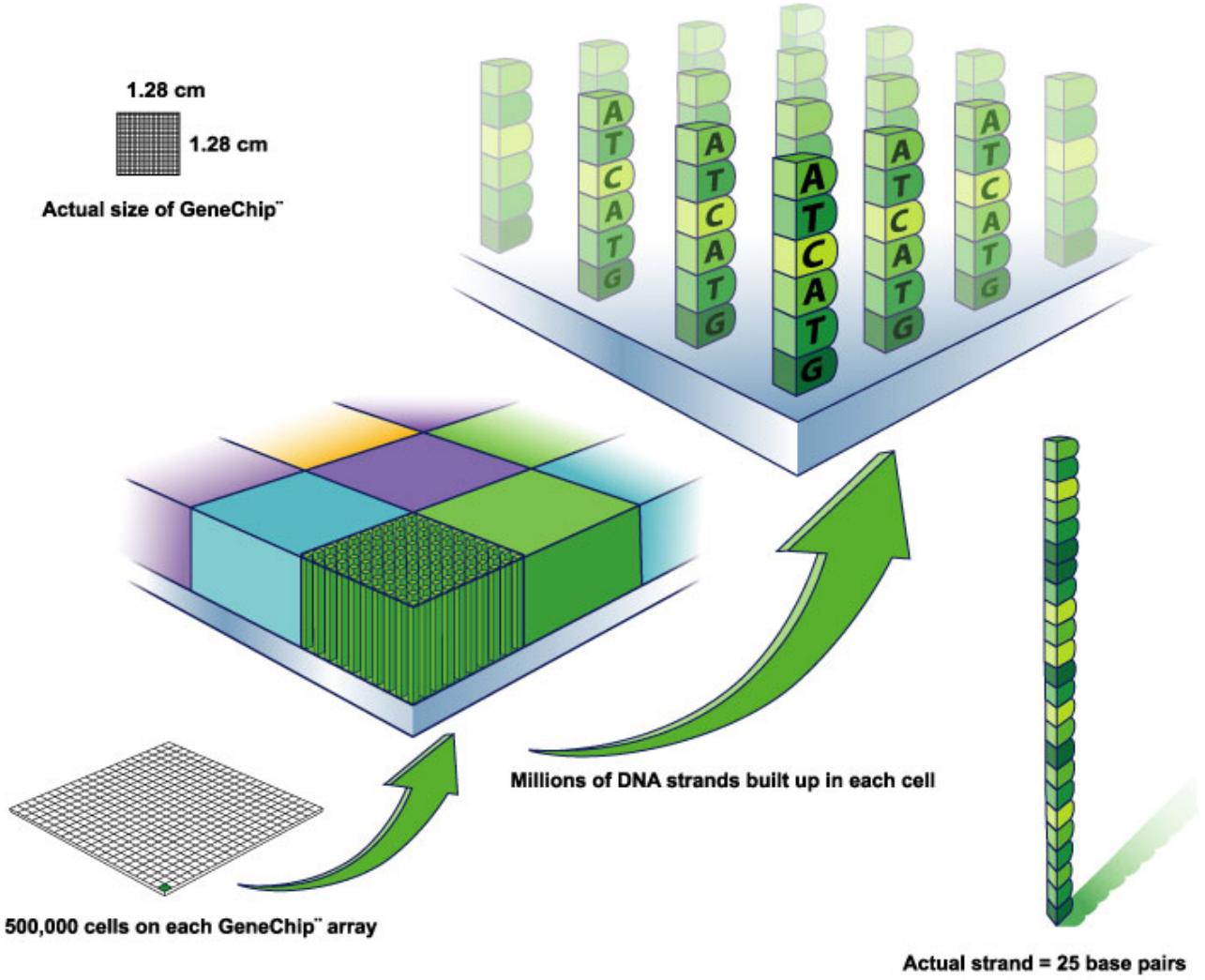
- Affymetrix (high density, one color)
- Agilent (circles on grid, one or two color)
- Illumina (high density, one or two color)
- Nimblegen (high density, one or two color)

Illumina uses beads instead of in-situ sequencing

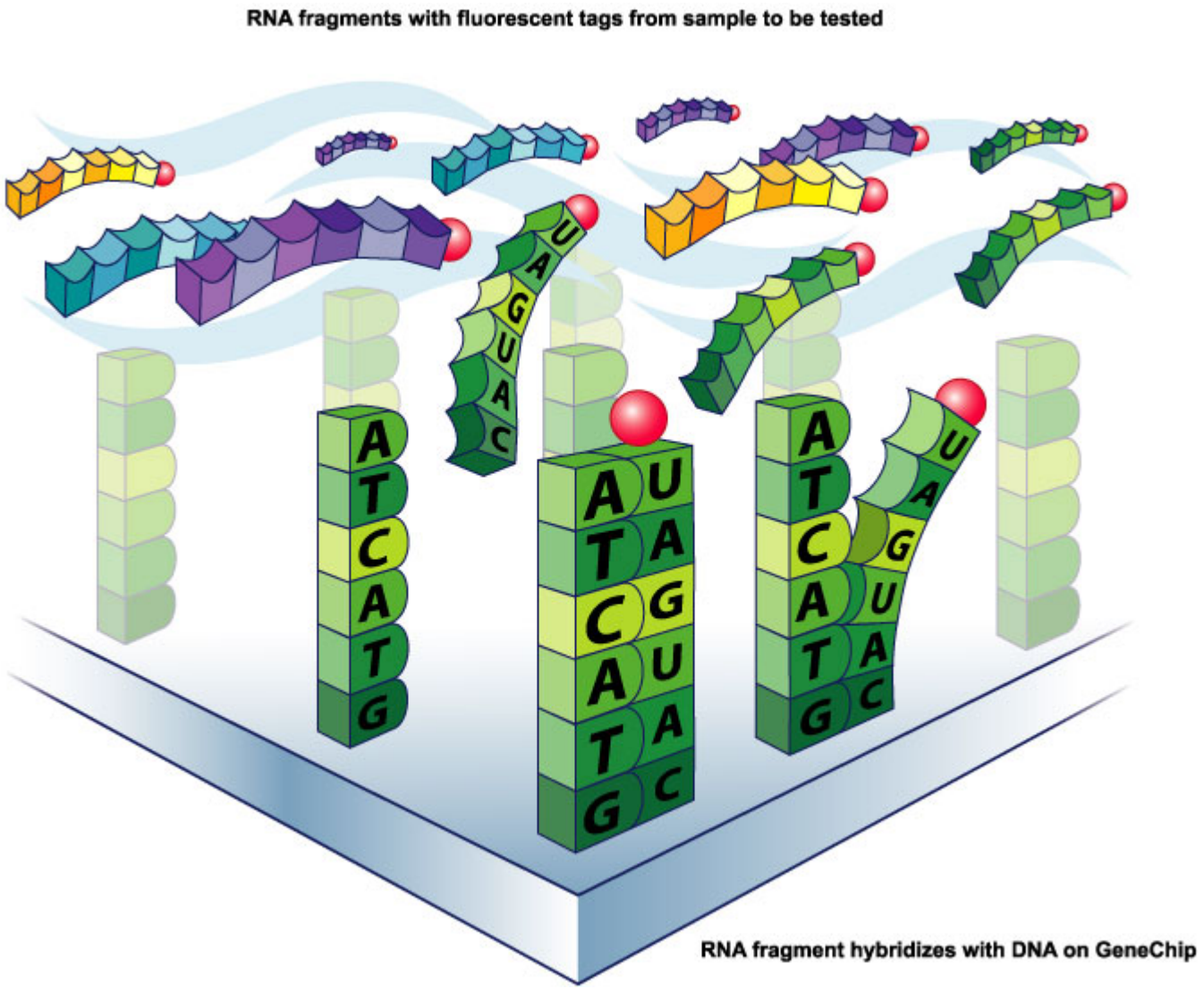
High density, one color

Affymetrix

Sequenced (High density)

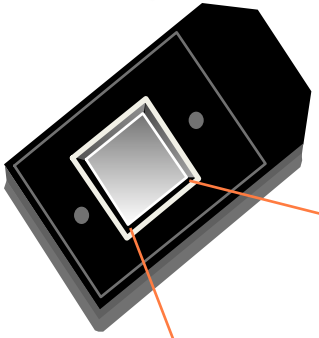


Hybridization of mRNA to probes



Affymetrix GeneChip® Arrays

GeneChip Probe Array



1.28cm

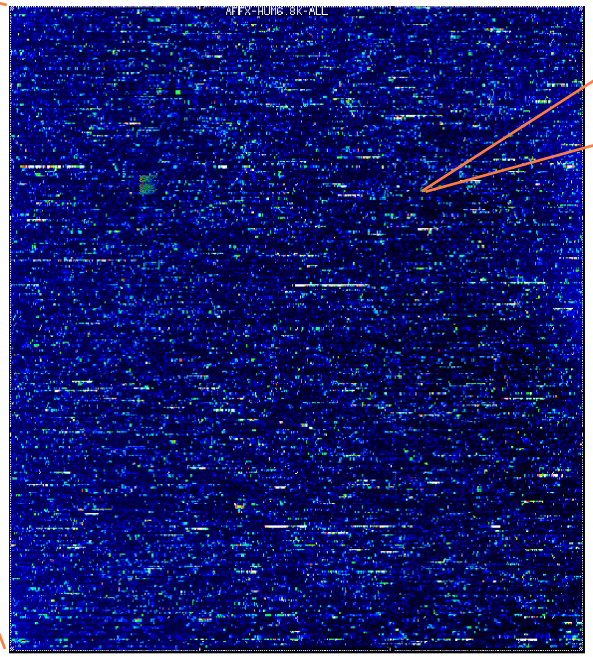
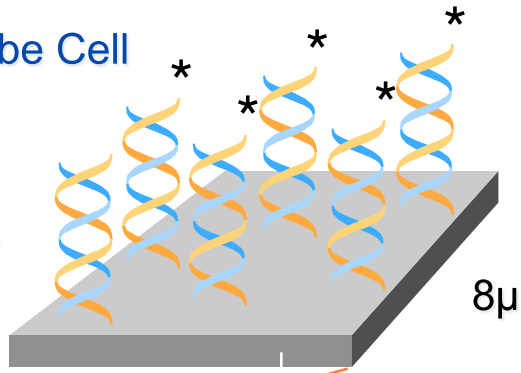


Image of Hybridized Probe Array

Hybridized Probe Cell

Single stranded,
labeled RNA target

Oligonucleotide probe

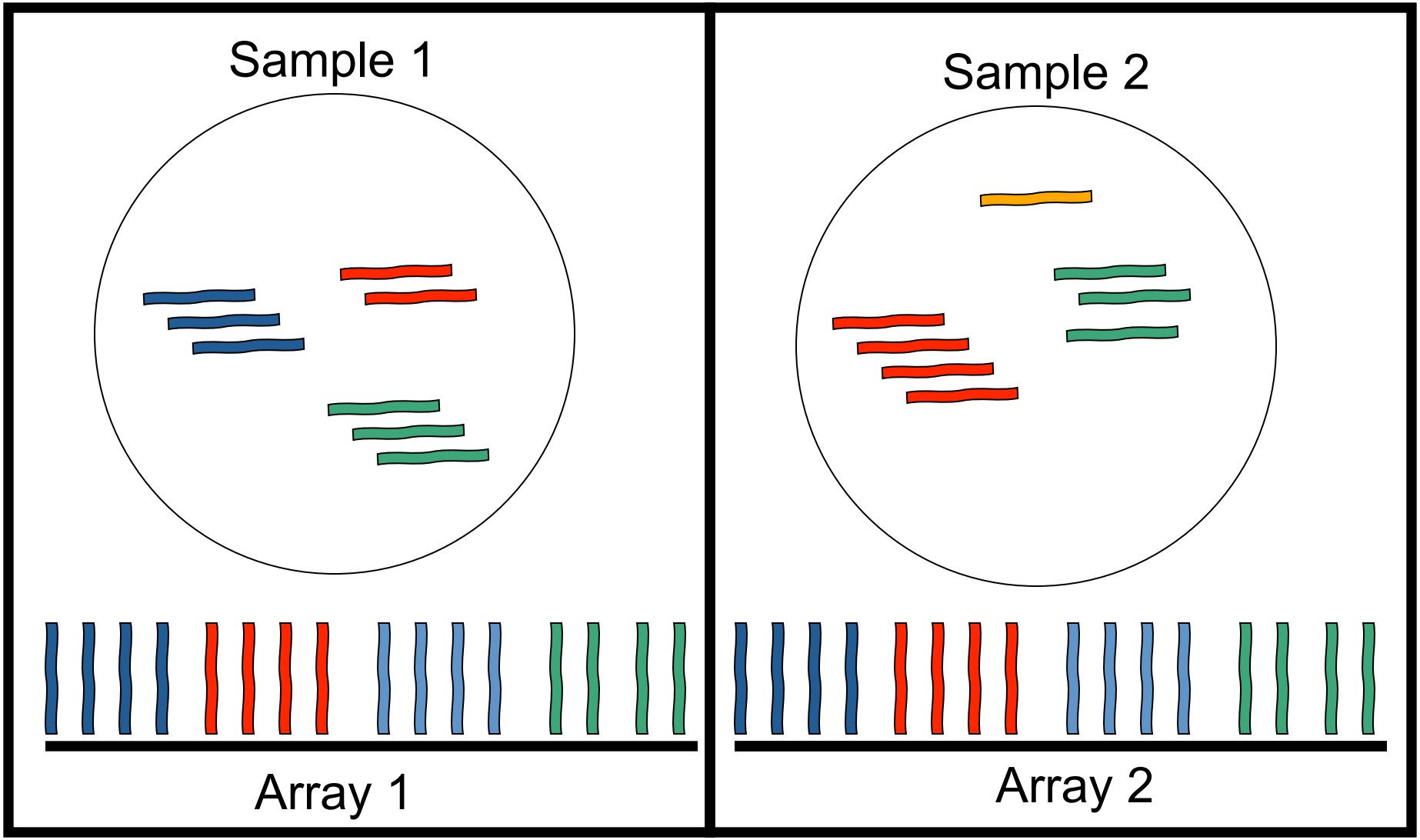


8µm

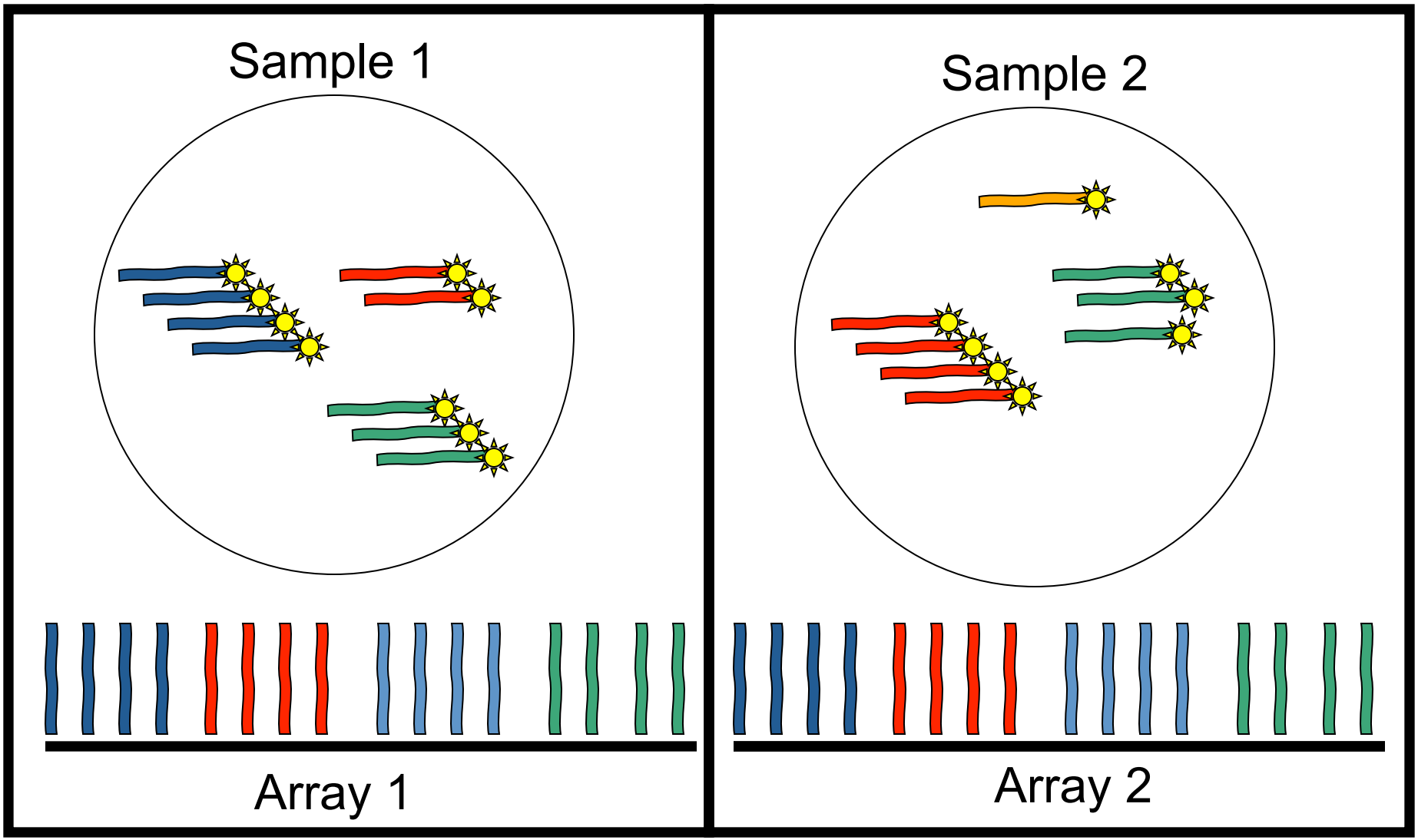
Millions of copies of a specific oligonucleotide probe

>1,000,000 different complementary probes

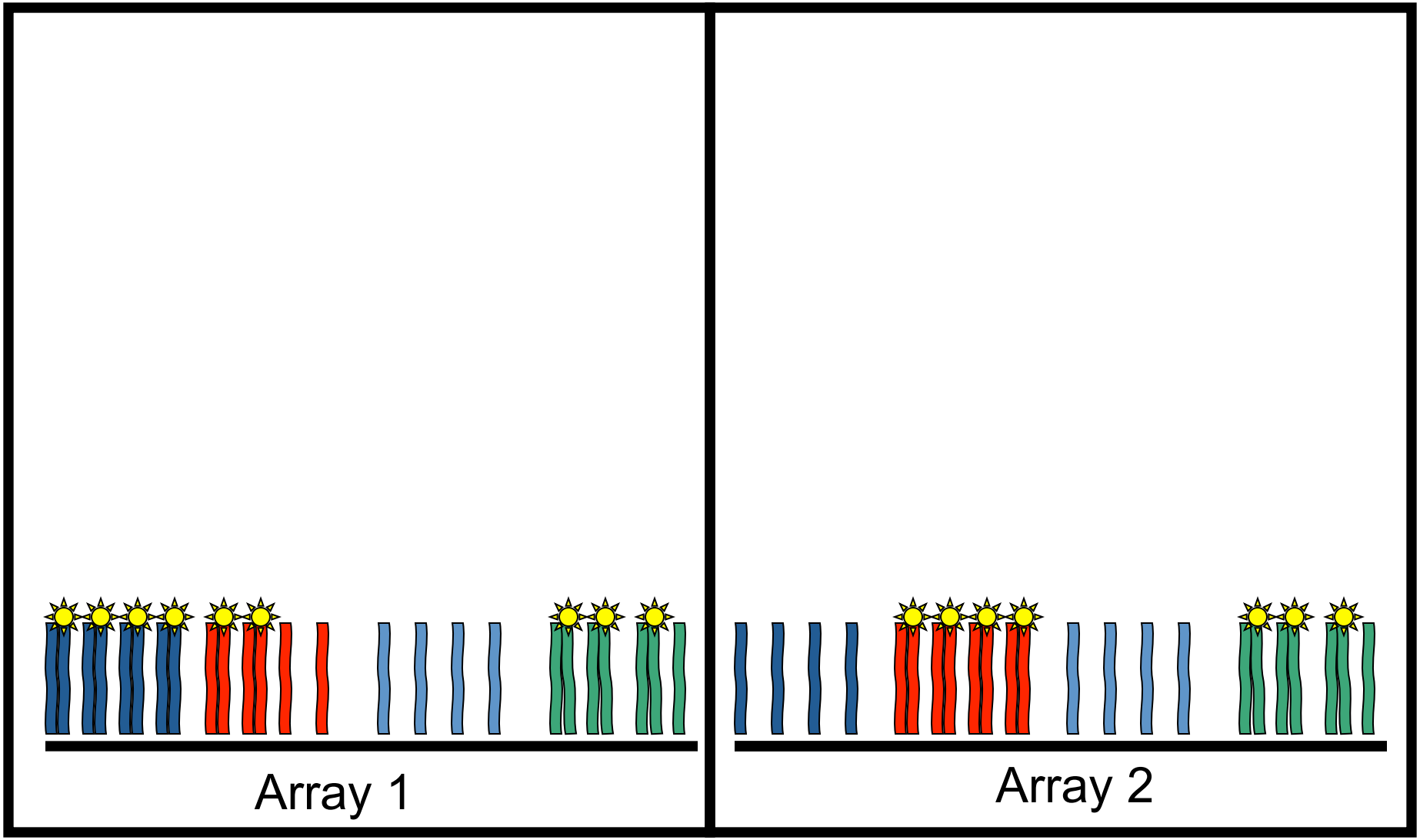
Before Labeling



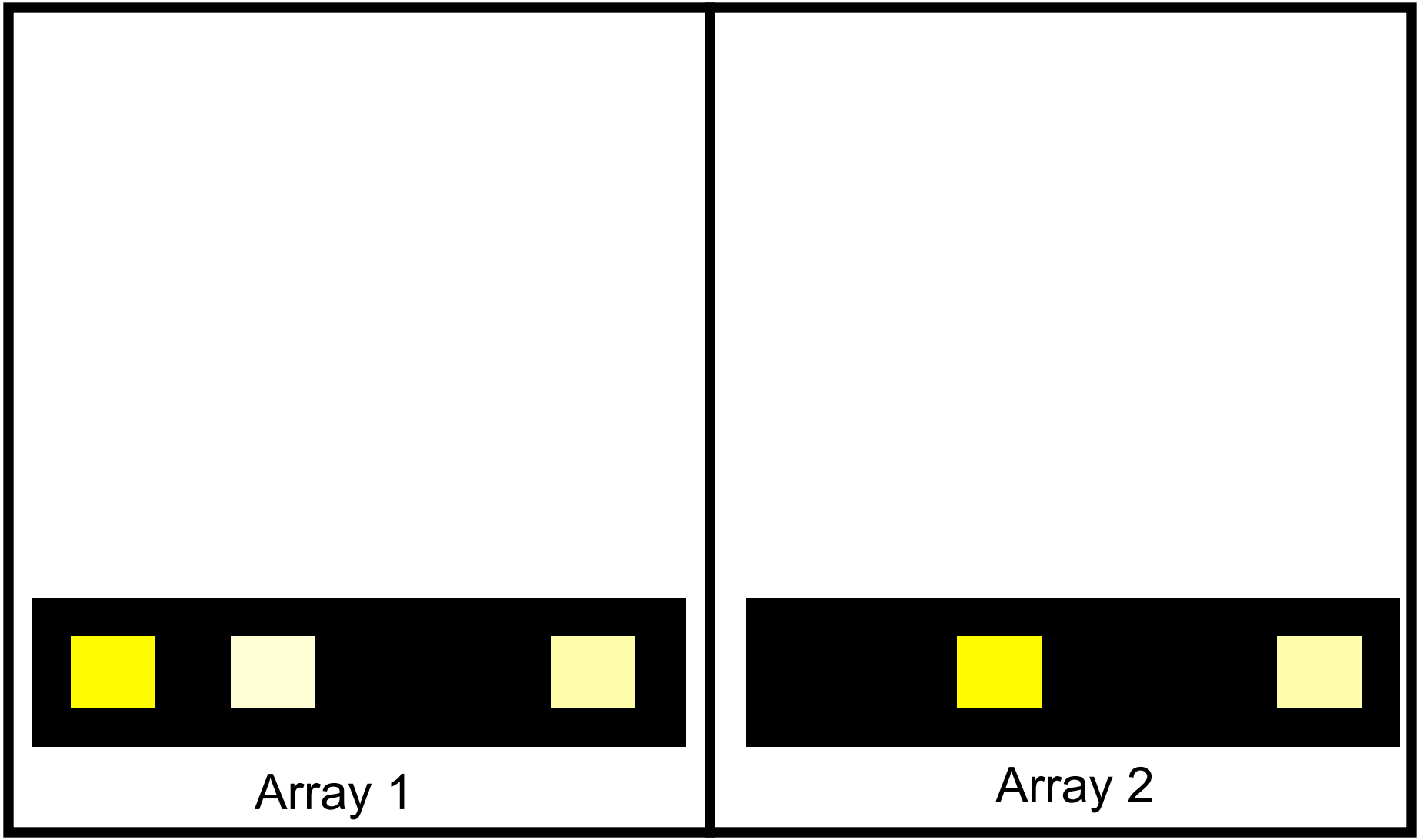
Before Hybridization: One Channel



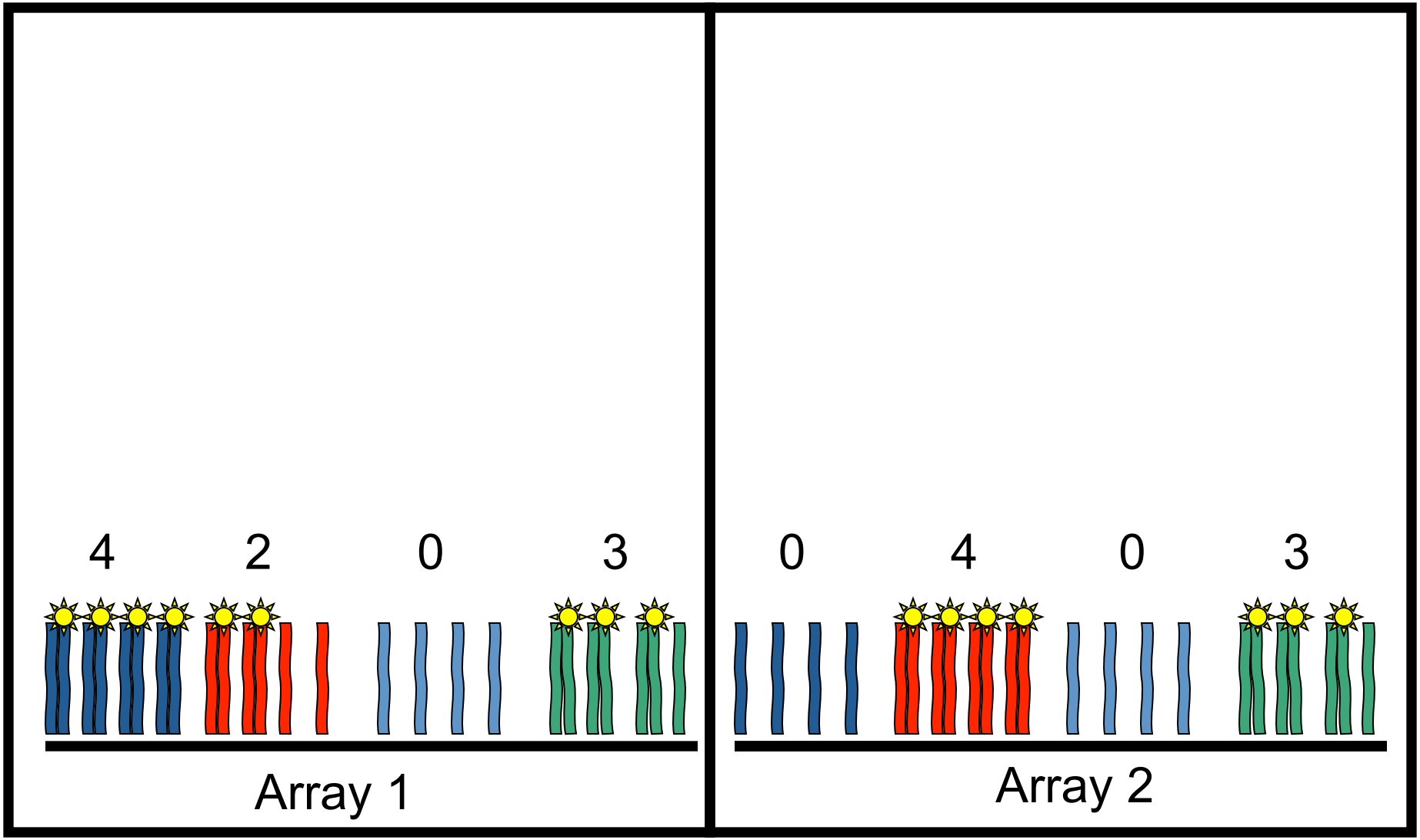
After Hybridization



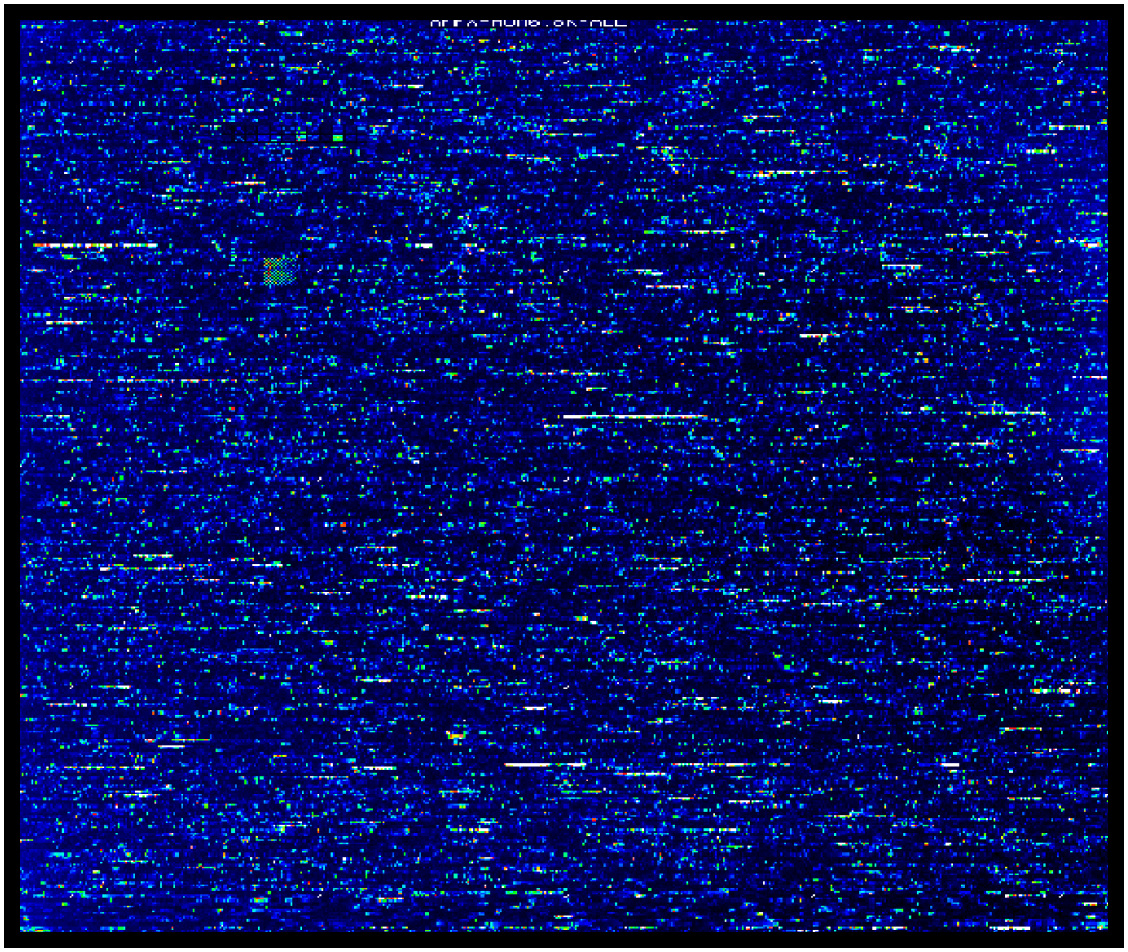
Scanner Image



Quantification

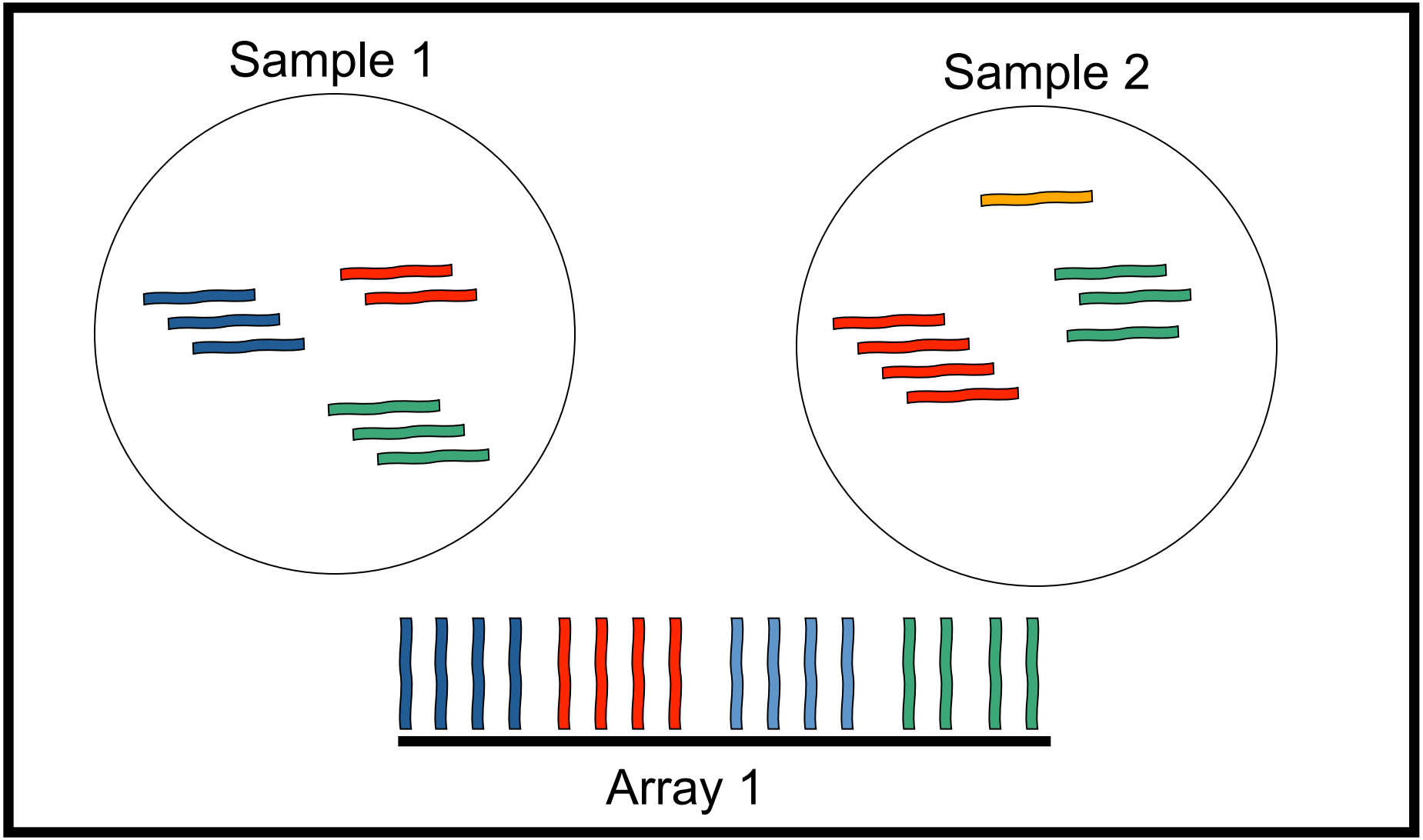


Microarray Image

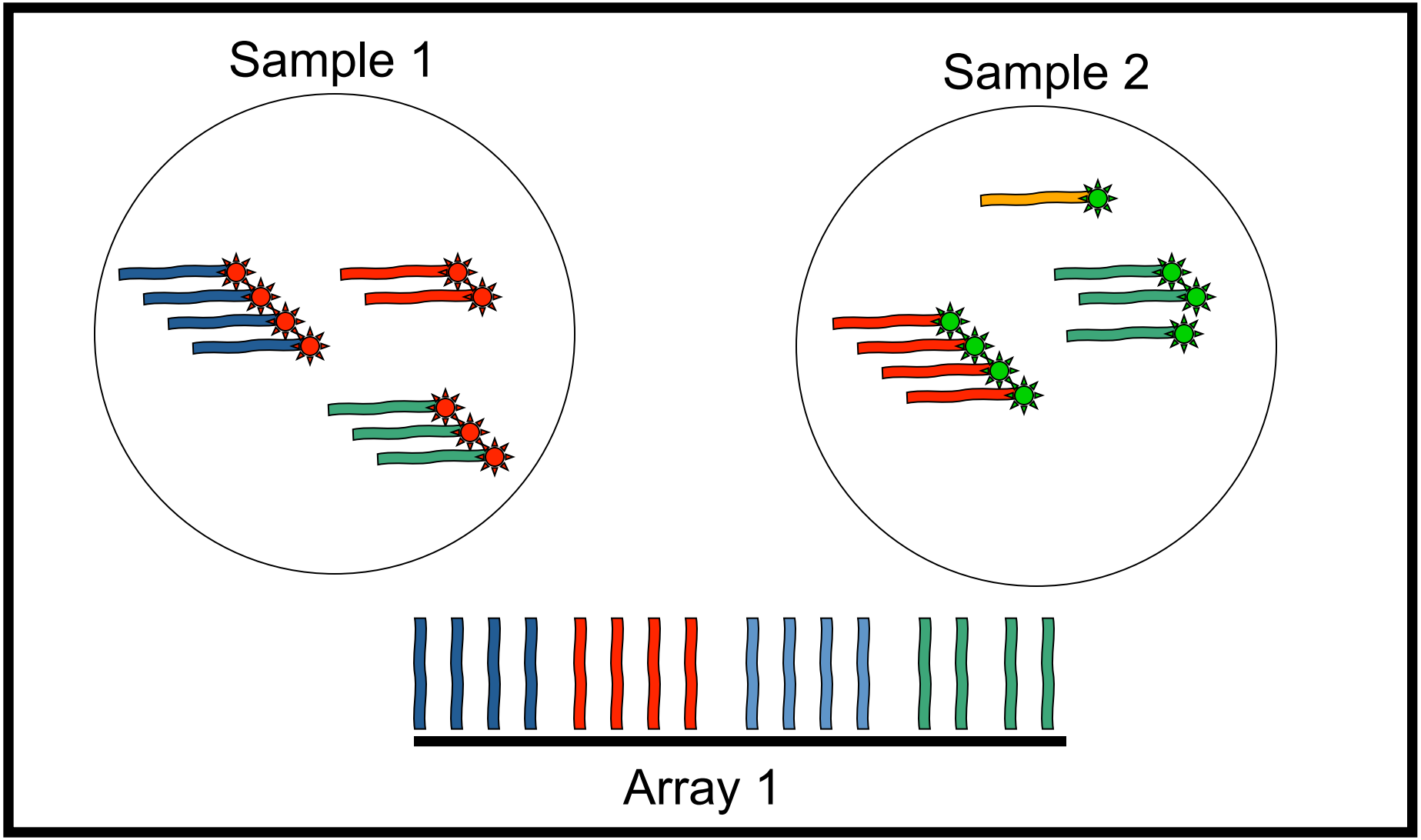


Two color, grid on circle

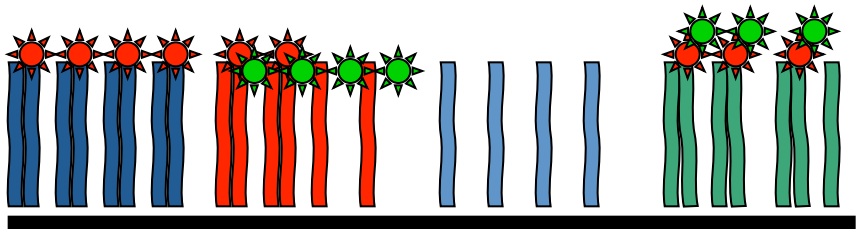
Before Labeling: Two Channel



Before Hybridization

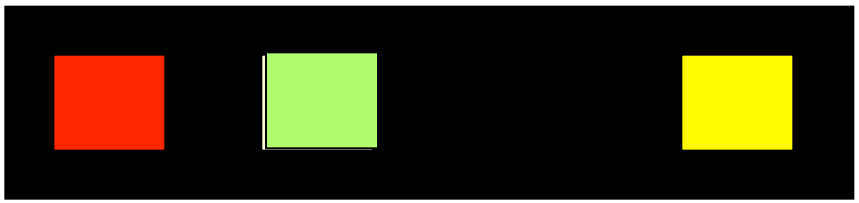


After Hybridization



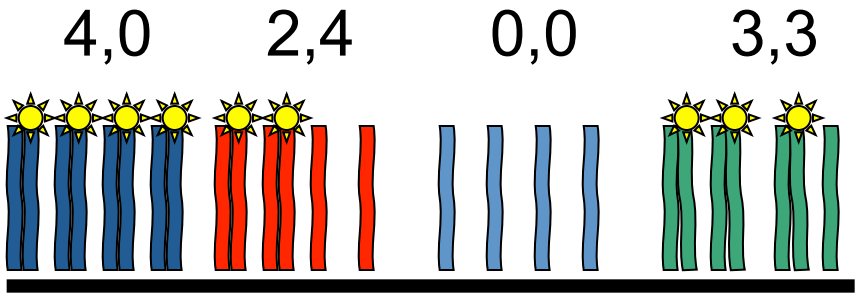
Array 1

Scanner Image



Array 1

Quantification



Microarray Image