

Welcome and introduction

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Rita Holdhus
Intoduction to Microarray technology
September 2009



NMC Course organization

- Introduction to microarrays (2 days)
- Analysis course (3 days)
 - J-express
 - R/BioConductor
- Workshops
 - Data analysis
 - Every last Friday of the month
 - Participants should have their own dataset
 - BASE

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Course program – Day 1

Thursday 17th September 2009

Conference room C at VilVite Center

09.00 – 09.20: Welcome - Introduction

09.20 – 09.50: Different microarray applications

09.50 – 10.35: Microarray technologies

10.35 – 10.50: Break

10.50 – 11.35: Microarray pipeline

11.35 – 12.20: Lunch

12.20 – 12.50: Examples of different plots (gene graphs, box plot, CA-plot, array plot etc.)

12.50 – 13.10: Case study I: Gene expression in rat brain

13.10 – 13.30: Case study II: DNA copy number changes (Array-CGH and SNP-analysis)

13.30 – 13.45: Break

13.45 – 15.15: Experimental design with practical exercise

15.15 – 15.30: Questions

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Course program – Day 2

Friday 18th September 2009

Conference room C at VilVite Center

09.00 – 10.30: Quality Control and outlier detection

10.30 – 10.45: Break

10.45 – 12.15: Preprocessing (filtering, normalization)

12.15 – 13.00: Lunch

13.00 – 15.15: Introduction to data analysis

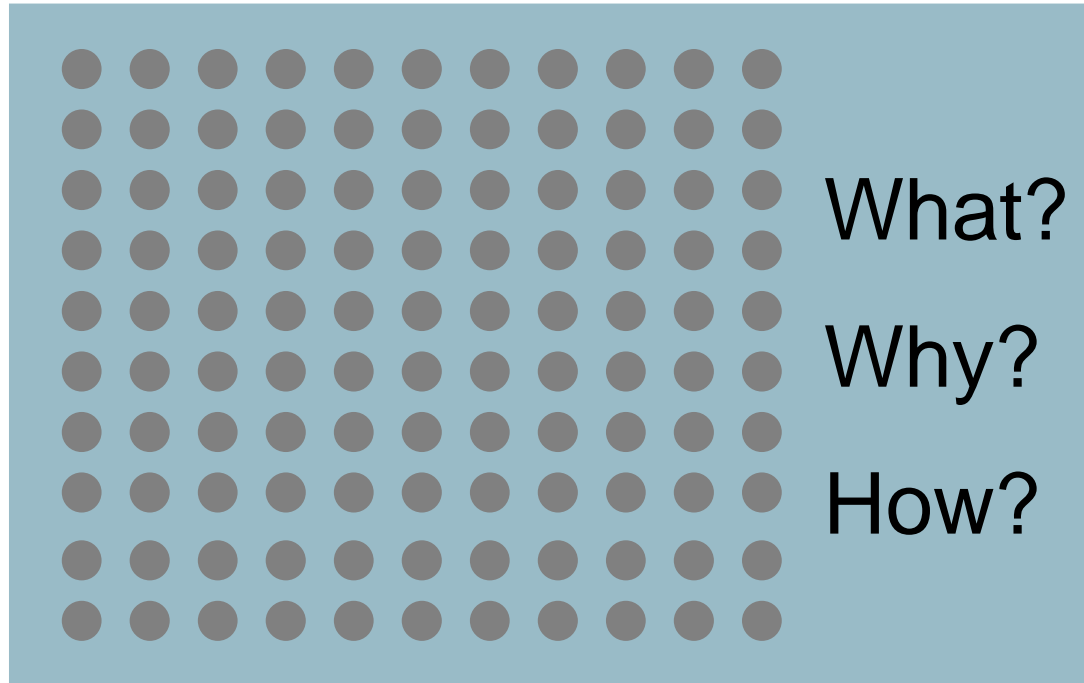
- Differential expression
- Explorative analysis
- GeneOntology/Pathways

15.15 – 15.30: Questions

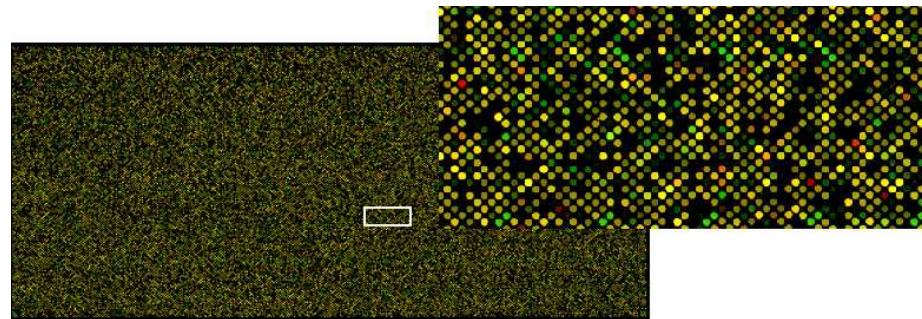
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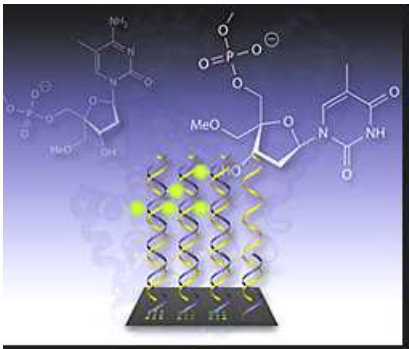
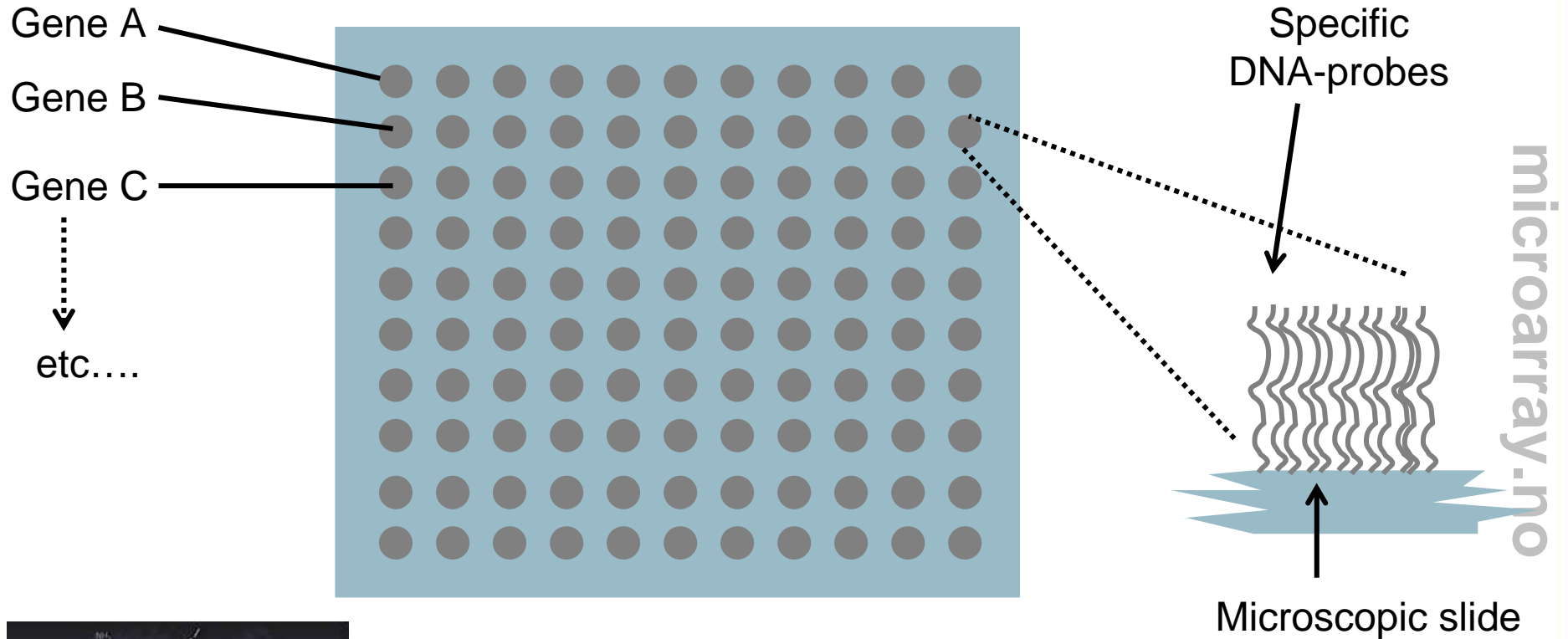
Short introduction to microarrays



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What is a microarray



Evolution of microarrays

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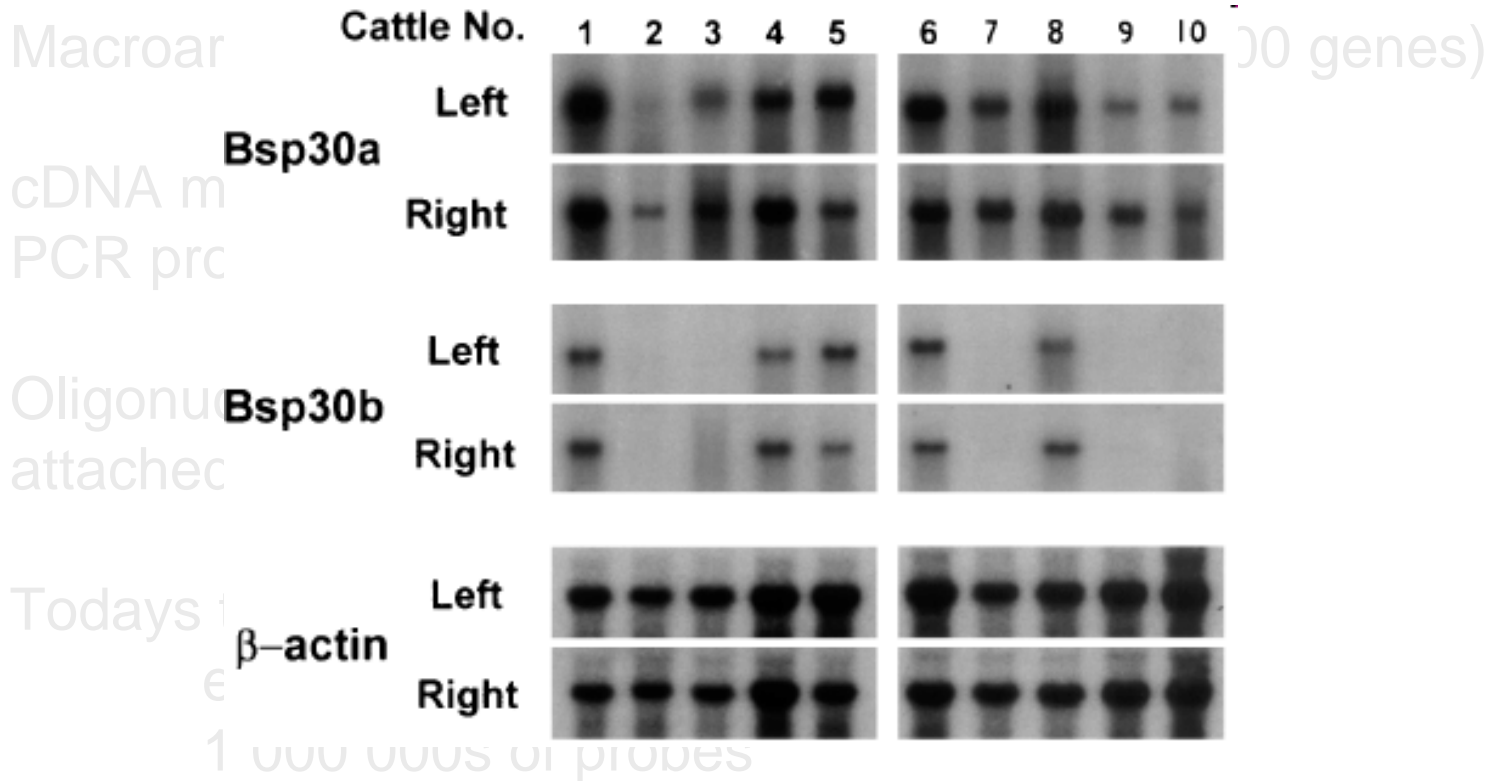
- 1977 Multiple Northern blots
- 1987 Macroarrays
- 1995 cDNA microarrays
- 1996 Oligonucleotide arrays
- 2003 Today's technology – High density arrays
- 2005 Next-generation



Evolution of microarrays – Northern blots

1977

Multiple Northern blots



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Next-generation; single-molecule sequencing

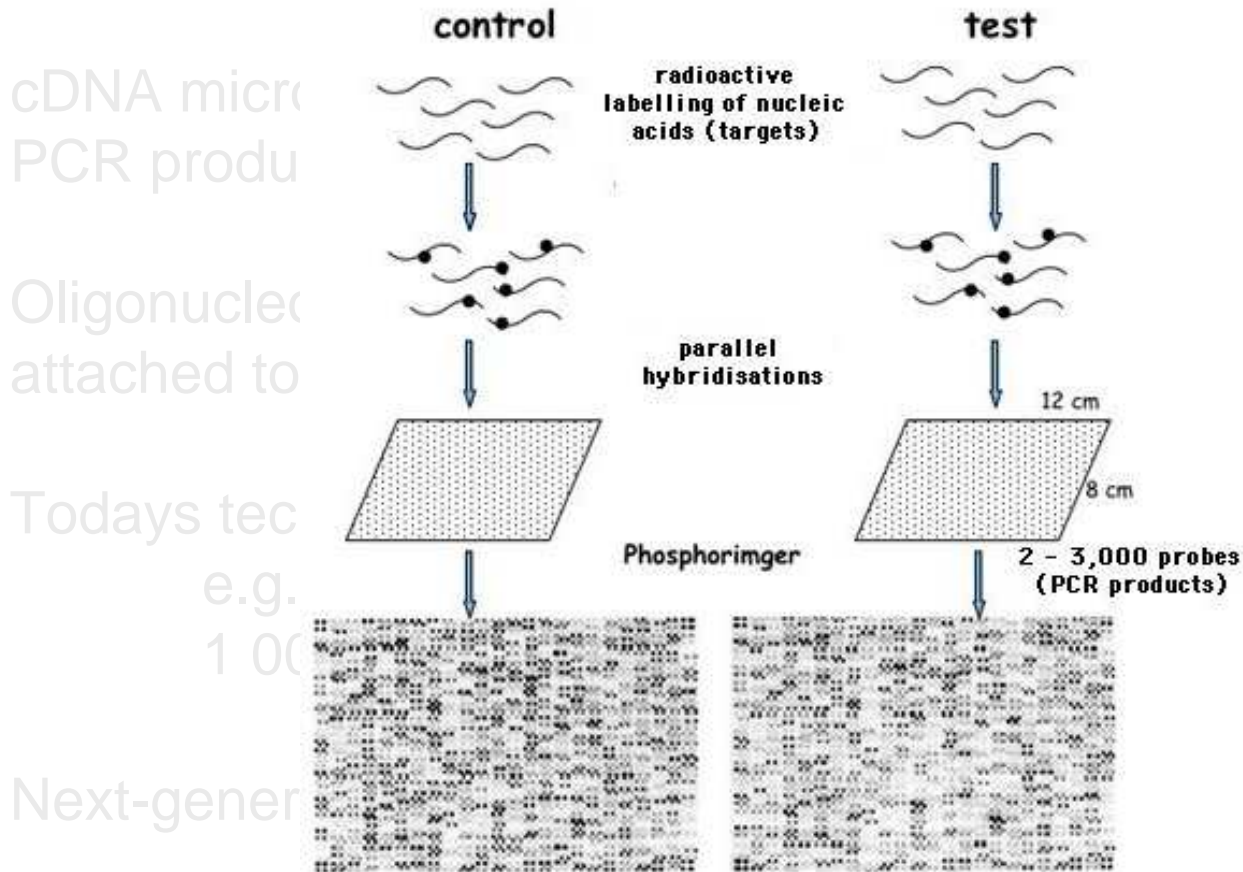


Evolution of microarrays – Marcoarrays

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1987

Macroarrays (spotted cDNAs, nylon filters, ~1000 genes)



Multiple Northern blots

cDNA micro
PCR produ

Oligonucle
attached to

Today's tec
e.g.
1 00

Next-gener



Evolution of microarrays – Mircoarrays

Multiple Northern blots

Macroarrays (s

1995

cDNA microarr
PCR produced

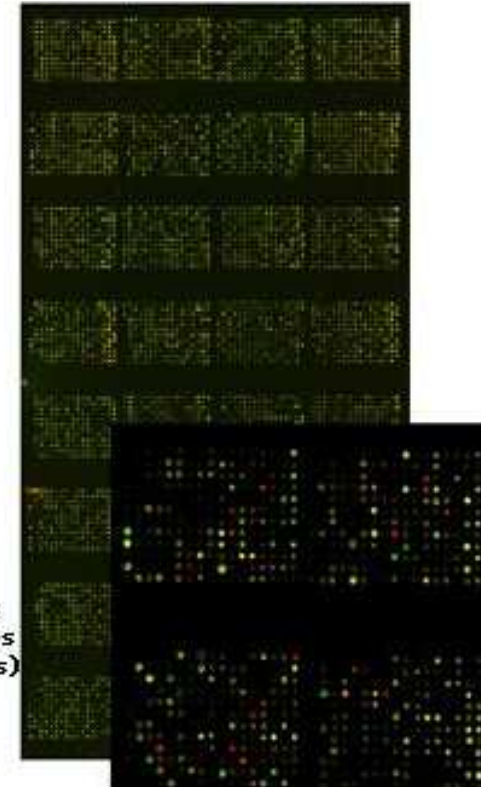
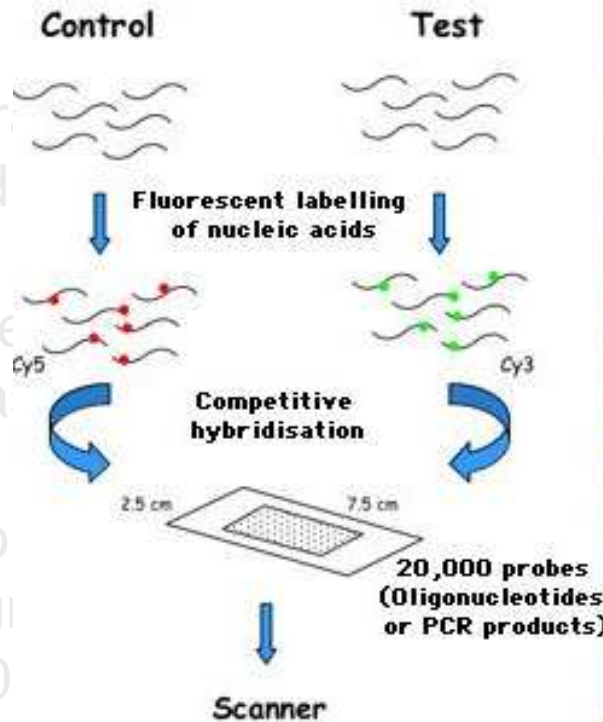
Microarrays

1996

Oligonucleotide
attached to gla

Today's techno
e.g. Illumina
1 000 0

Next-generation; single-molecule sequencing



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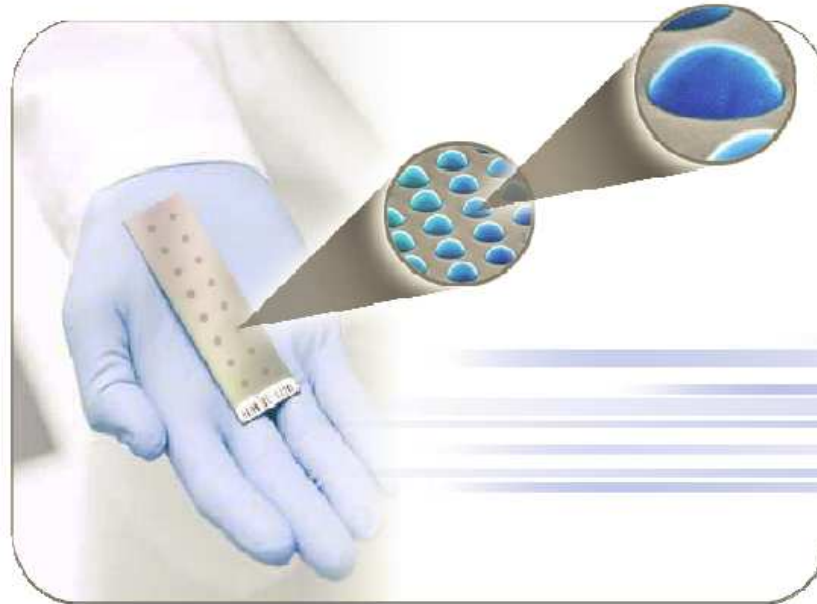
Evolution of microarrays – High density arrays

Multiple North

Macroarrays

cDNA microarrays
PCR products

Oligonucleotides
attached to glass



1 000 000 genes)

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2003

Today's technology – High density arrays
e.g. Illumina Bead arrays; 50 nt probes;
1 000 000s of probes

Next-generation; single-molecule sequencing



Evolution of microarrays – High throughput sequencing

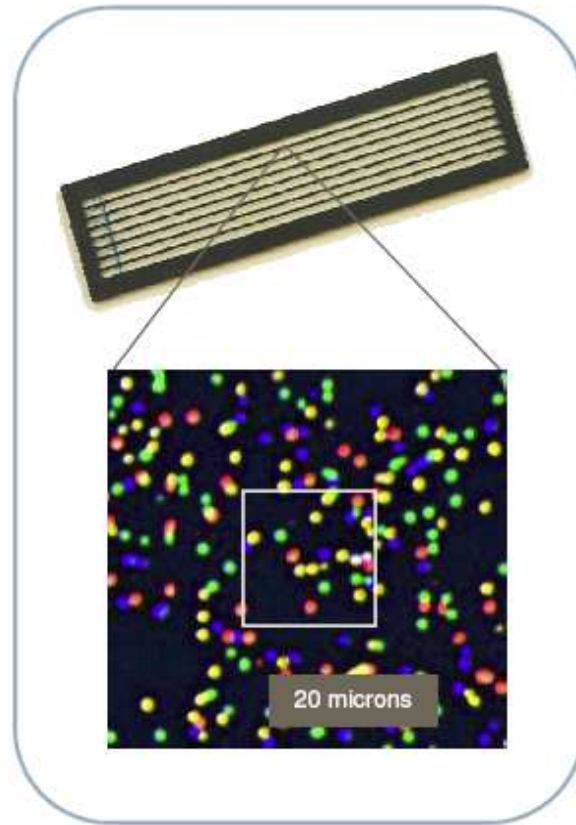
Multiple Northern blots

Mac

cDN
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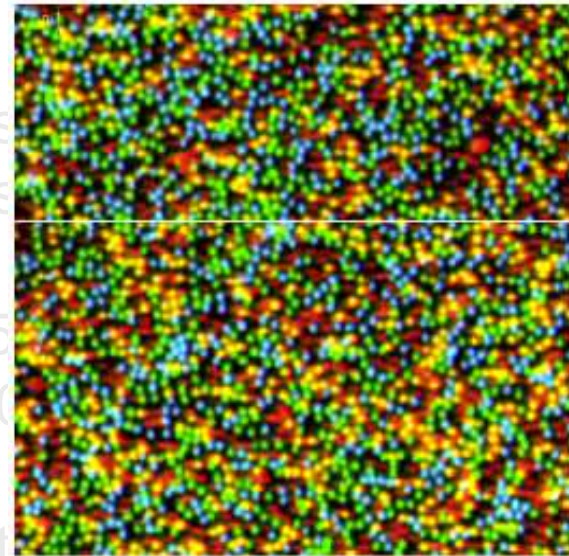
nylon filters... (1,000 genes)

res
ass

~5
100

sit

ys; 50 nt probes;



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2005

Next-generation; single-molecule sequencing



Why use microarrays

- Each cell type expresses ~ 10- 20 000 genes
- Physiological and pathophysiological responses are linked to changes in gene expression
- Knowledge of gene expression variation at different states may create new hypotheses about gene function and underlying mechanisms

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Functional genomics

Biology

Cell culture

Organ

Organism

Which genes are involved in a given biological process?

What are their functions?

Genomics

~ 30 000 genes

DNA sequence

Protein sequence

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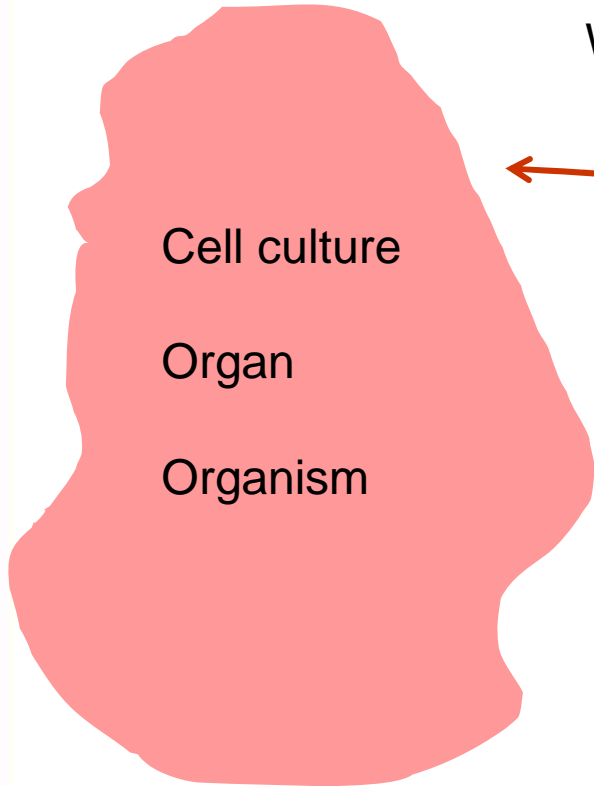
Functional genomics

Biology

Which genes are involved in a given biological process?

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Genomics

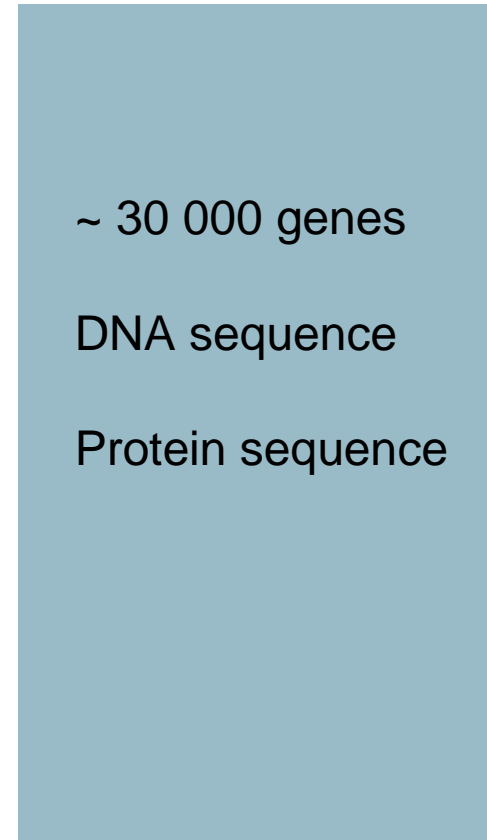


Cell culture

Organ

Organism

High-throughput
analyses



~ 30 000 genes

DNA sequence

Protein sequence

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Parallel analysis of 1000s of genes and proteins



High- throughput analysis

- Gene expression (gene activity)
- Sequence variations (SNPs/mutations)
- Chromosome copy numbers
- DNA-binding proteins
- DNA methylation
- Protein profiles

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