

Advanced genetics - 203.305

Microarray - Hands-on data analysis

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Planning

- **15.9.14** – Introduction (lecture), *AHB2.38*
- **22.9.14** – Paper discussion, *AHB2.38* - **Discussion worksheet due**
- **23.9.14** – From raw data to lists of differentially expressed genes (Step by step analysis of a microarray data set using the R language, **3h lab**, *SC5.10*)
- **29.09.14** – **Lab discussion** (feedback!) and new developments in global gene expression analysis, *AHB2.38*
- **30.09.14** – Biological interpretation of microarray data (Gene ontology analysis using the R language + online research of candidate genes, **3h lab**, *SC5.10*)

Microarray studies

1. **Indroduction**
2. Microarray technology
3. Statistics
4. Gene expression databases and MIAME
5. Examples of microarray studies (paper discussion topic and lab topic)

Microarray applications

- **Gene expression analysis**
- Re-sequencing
- SNP-analysis
- DNA-Protein interactions
- Discovery of new transcripts/alternative splice variants

Expression Studies

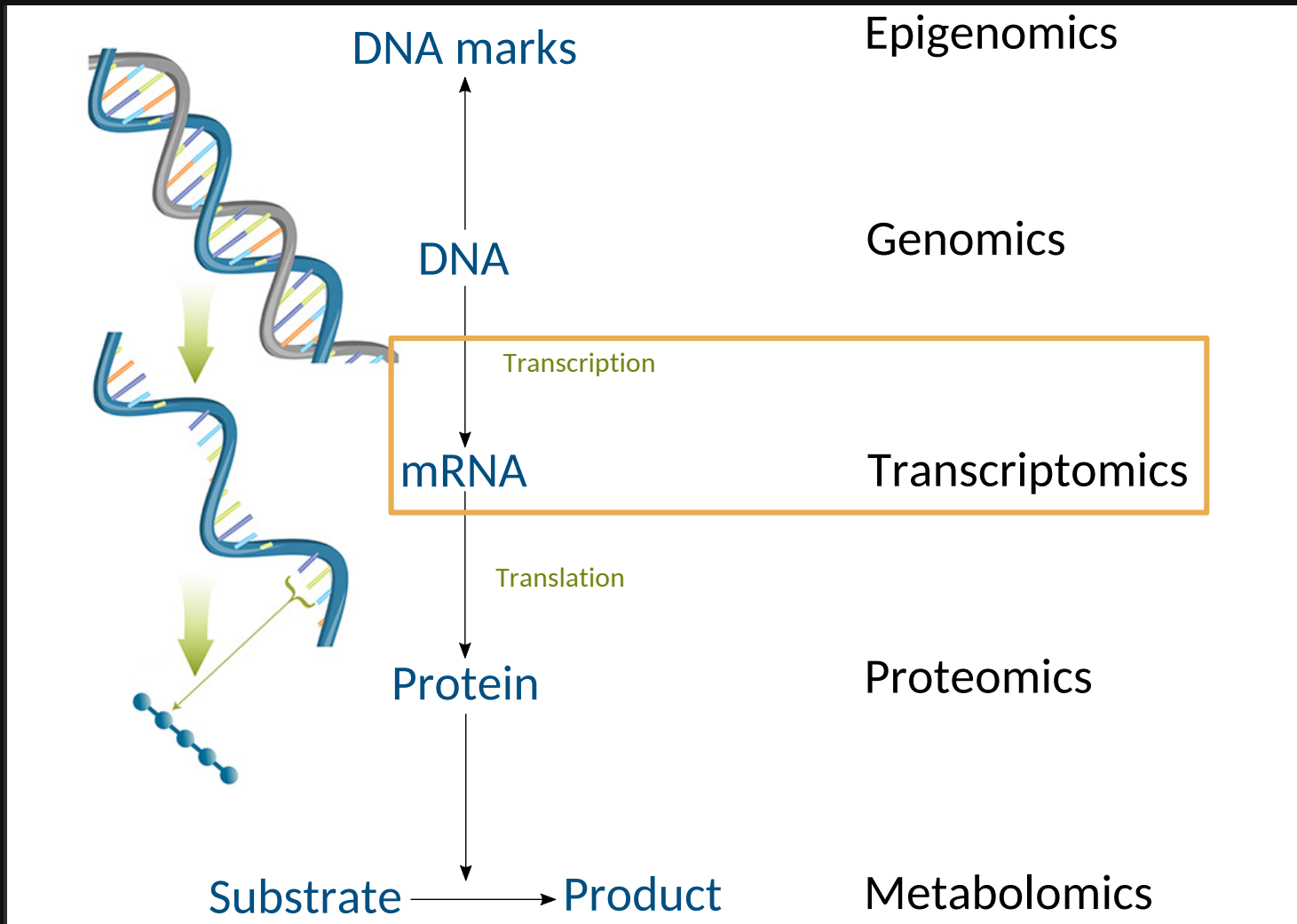


Figure modified from: Katherine Joyce, Woods Hole Oceanographic Institution

Definitions

- **Genome**: entire DNA sequence of an organism
- **Epigenome**: chemical marks of the genome that modify its expression
- **Transcriptome**: all gene transcripts present in a given cell/tissue at a given time (“snapshot”)
- **Transcriptomics**: global analysis of gene expression = genome-wide expression profiling

Definitions

- **cDNA**: complementary DNA made from mRNA by the enzyme reverse transcriptase
- **EST**: Expressed Sequence Tag, small pieces of an expressed gene (cDNA)
- **Hybridization**: based on complementary molecules, sequences that are able to base-pair with one another. When two complementary sequences find each other, they will lock together, or hybridize (primer annealing, probe-target binding etc).

Genome-wide expression studies - Medical applications

- **Cancer research:** Cell-cycle monitoring, genetic markers detection
- **Drug development and response:** Treatment-induced expression pattern
- **Diagnosis:** Disease-associated expression patterns

Genome-wide expression studies - Biological applications

- **Development biology**: comparison of different developmental stages
- **Ecology**: interactions between organisms (symbiosis, pathogenicity...) or between organisms and environment (temperature, nutrient...)
- **Evolution**: within and between species variation, hybrids vs. parents, diploids vs. polyploids
- **Functional analyses**: wild type vs. mutant

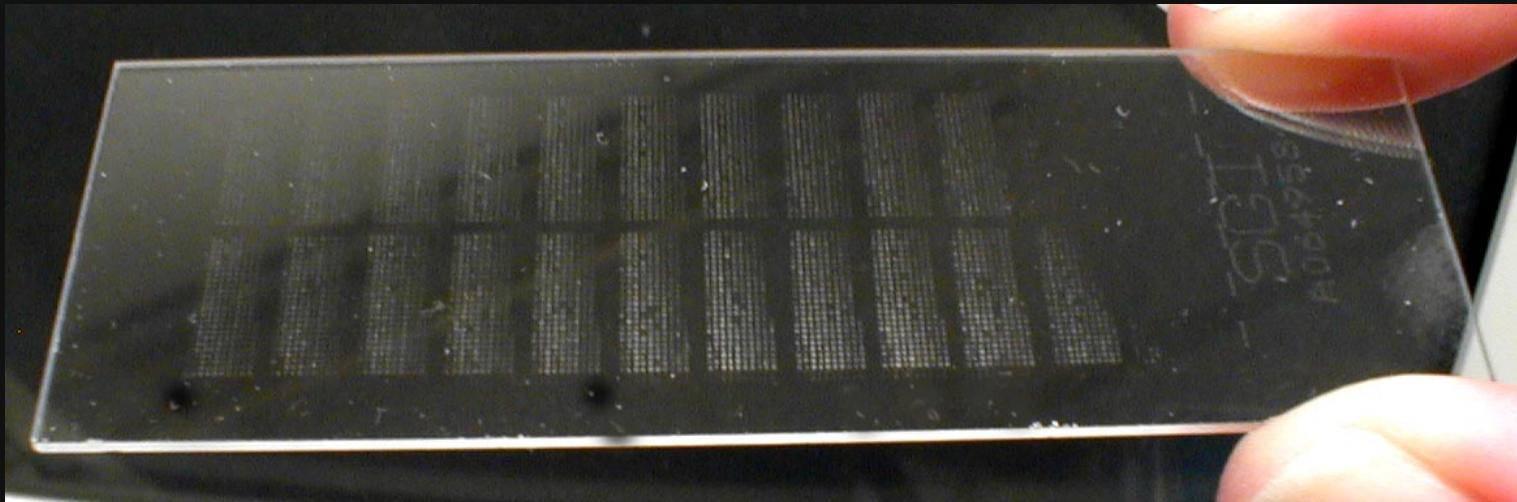
Hypothesis generating tool

Microarray studies

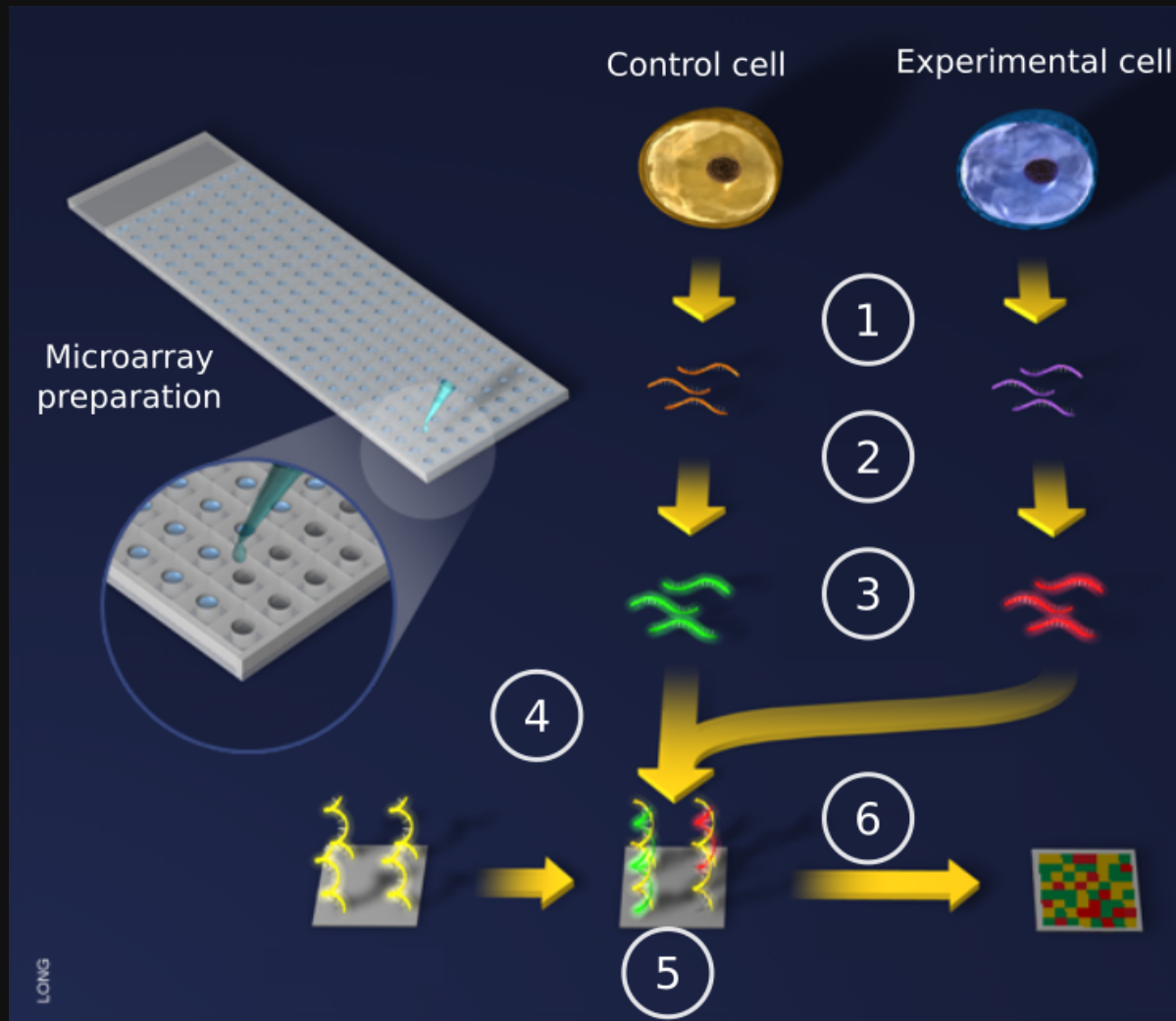
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What are microarrays?

A microarray is a **solid support** (such as a membrane or glass microscope slide) on which **DNA of known sequence** is deposited in a **grid-like array**.



Microarray analysis principle



Microarray analysis principle

