

Study cases

Gene expression data

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Two-channels microarray technology

Cell culture,
tissue, ...

RNA extraction

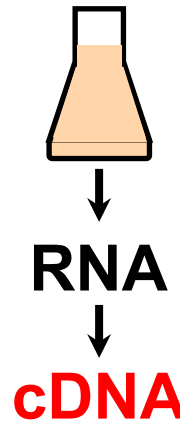
Synthesis of
fluorescent cDNA

Brightness \leftrightarrow Quantity

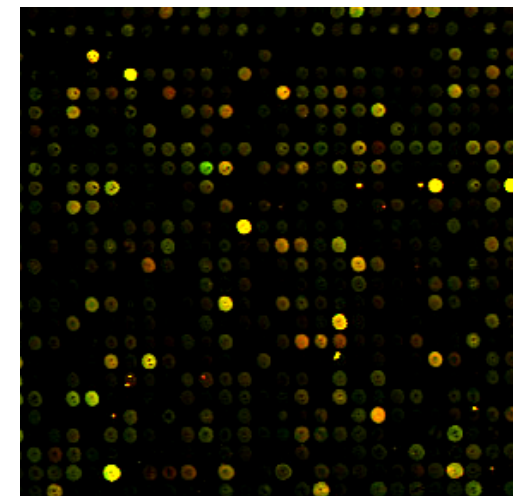
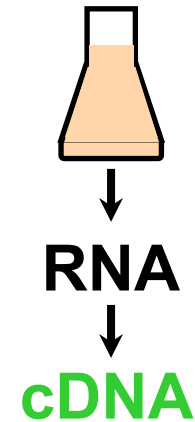
Color \leftrightarrow Specificity

yellowish	not specific
reddish	sample 1 - specific
greenish	sample 2 - specific

Sample 1

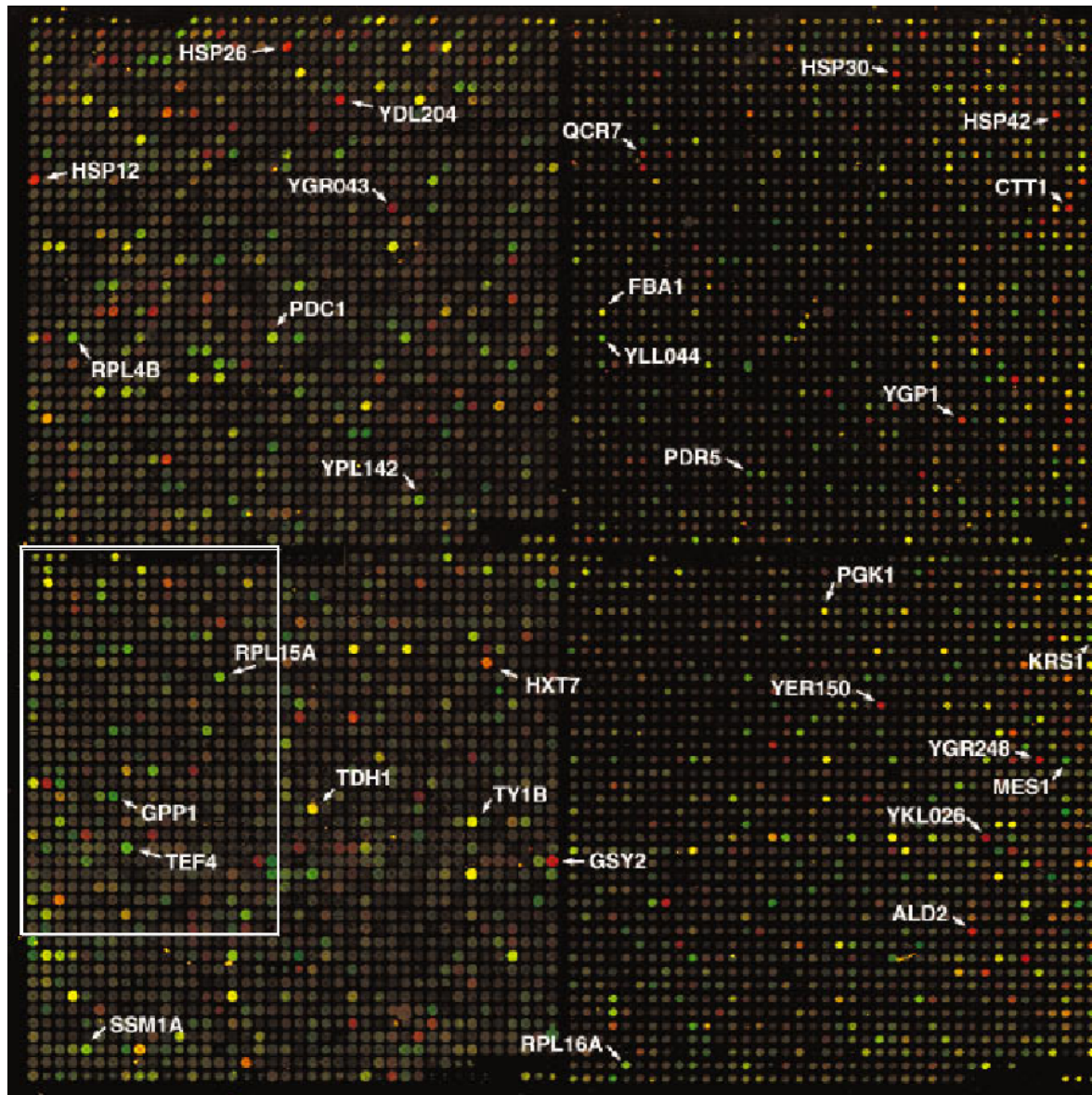


Sample 2



DNA chip

Complete microarray – two-channels, full cDNA, yeast



Two-channel microarrays - Raw intensity measurement

- Raw measurements
 - Red intensity
 - Red background
 - Green intensity
 - Green background
- $\text{Intensity} - \text{background} = \text{level of expression}$
 - *Red* in experimental conditions
 - *Green* in control

Two-channel microarrays : log-ratio computation

- The level of *regulation* is represented by the *ratio*

$$r = \frac{red - red.bg}{green - green.bg}$$

$r > 1 \rightarrow \text{up-regulated}$

$r < 1 \rightarrow \text{down-regulated}$

- The log-ratio provides a more convenient statistic (we will see why during the course)
- \log_2 is even more convenient because the scale is more intuitive than natural logarithms.

$$R = \log_2 \left(\frac{red - red.bg}{green - green.bg} \right)$$

$R < 0 \rightarrow \text{down-regulated}$

$R > 0 \rightarrow \text{up-regulated}$

$|R| > 1 \rightarrow \text{regulated by a factor of 2}$

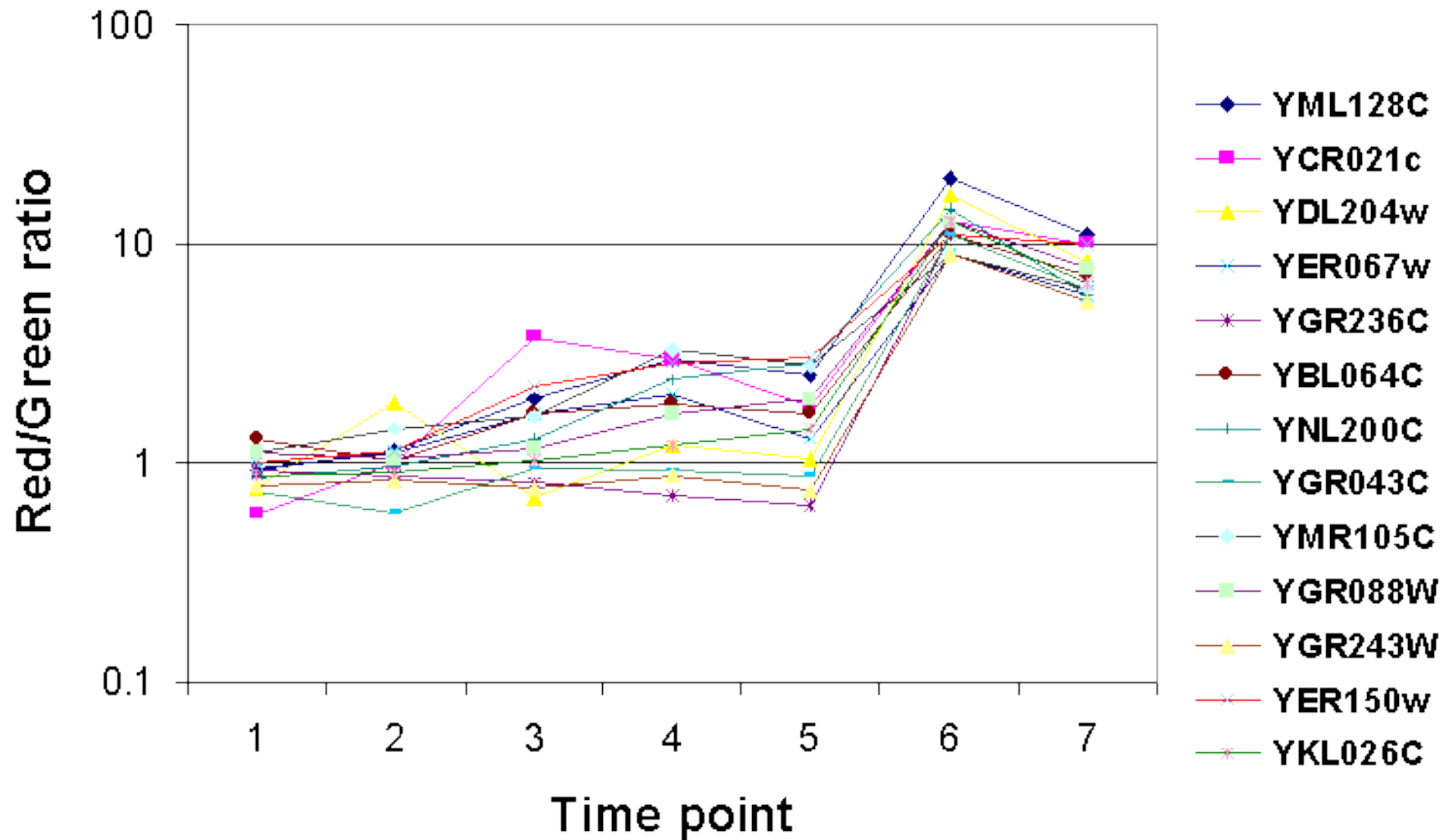
$|R| > 2 \rightarrow \text{regulated by a factor of 4}$

$|R| > w \rightarrow \text{regulated by a factor of } 2^w$

Examples of experimental conditions

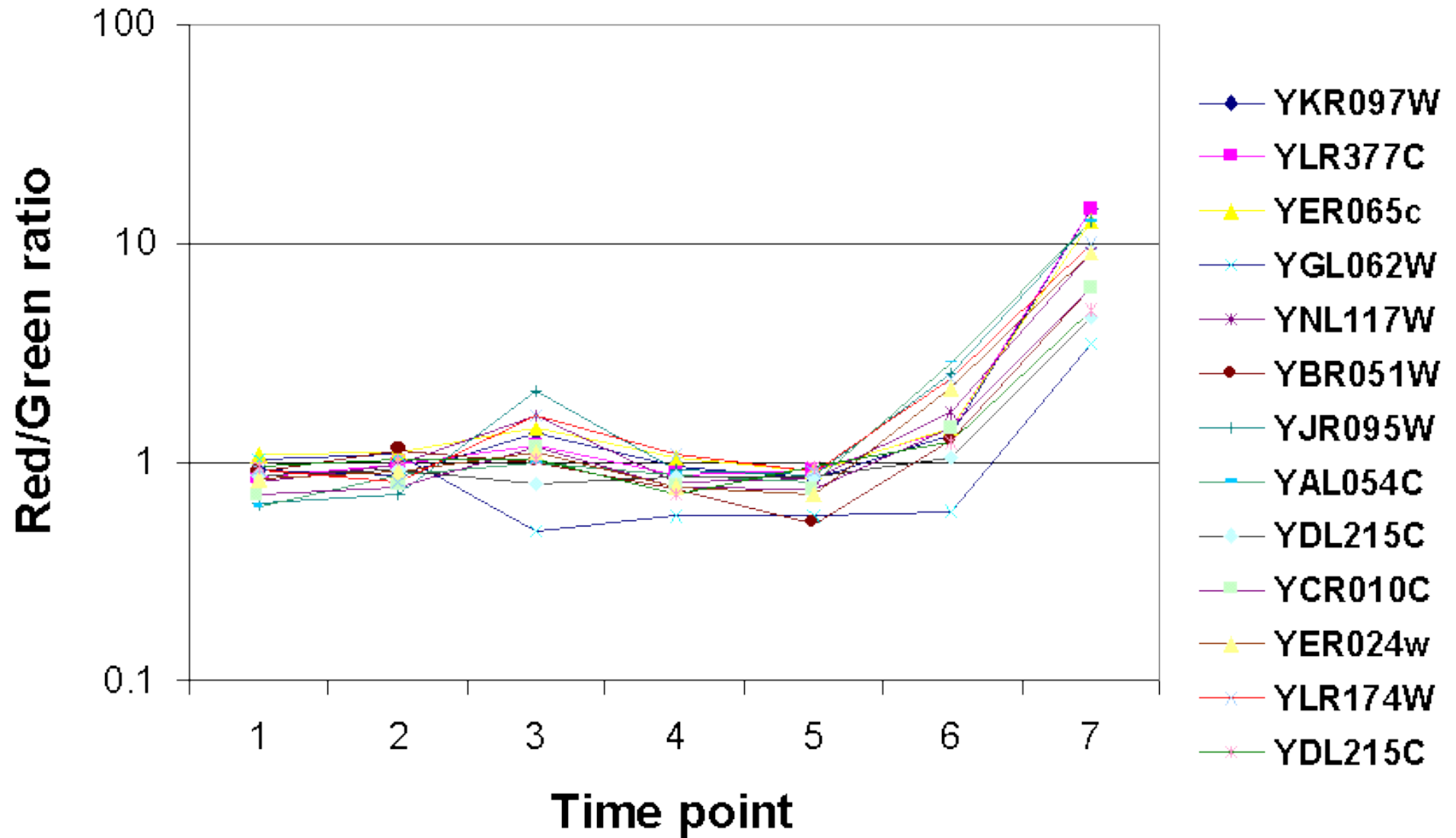
- Presence/absence of a metabolite
 - gal vs glucose
- Transcription factor mutants
 - Yap1p overexpression
 - TUP1 deletion
- Massive environmental changes
 - rich vs minimal medium
 - diauxic shift (7 time points during the shift)
- Cell differentiation
 - sporulation
 - mating type
- Cell cycle

Late activation during diauxic shift



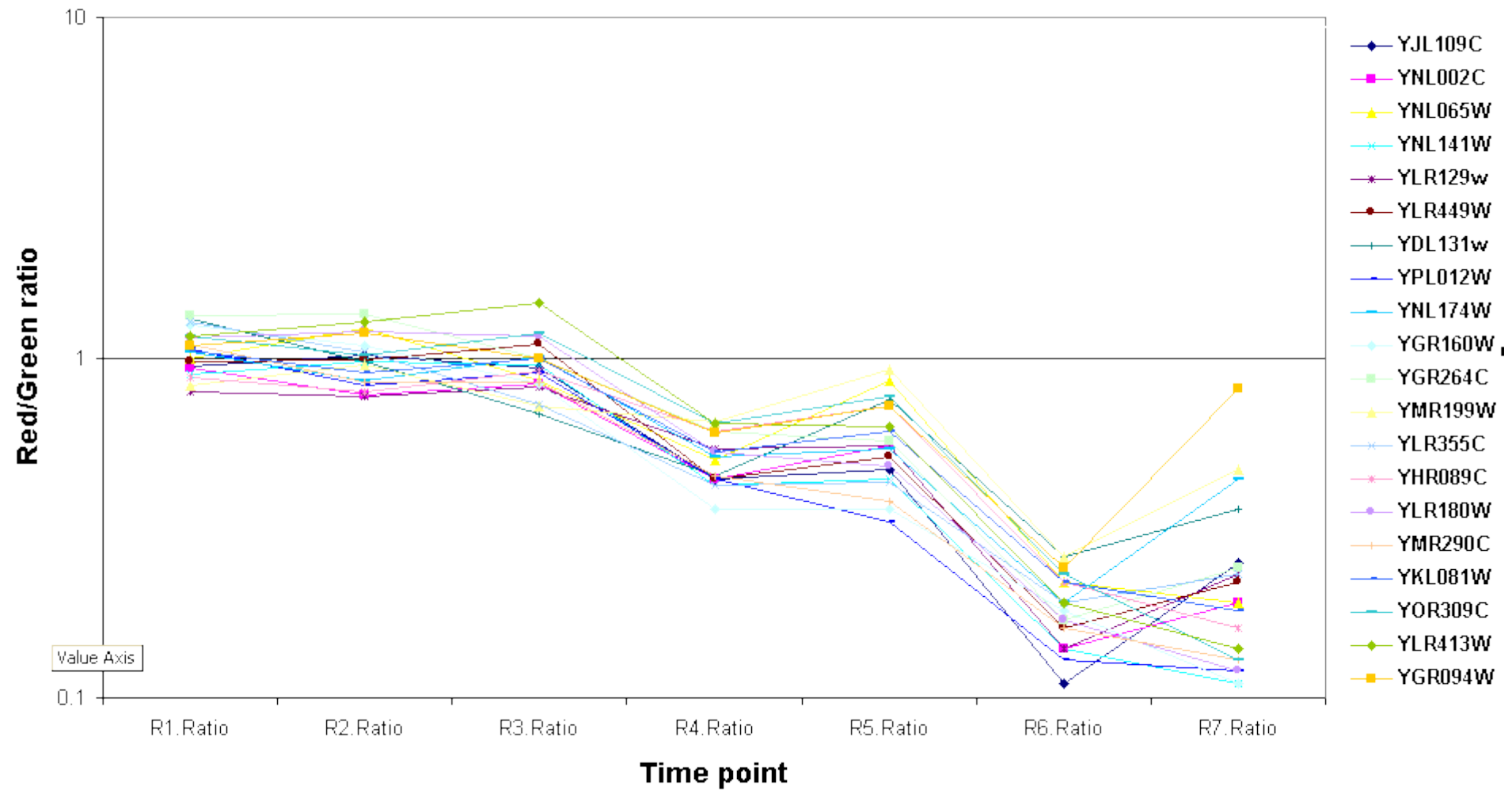
Data source: DeRisi JL, Iyer VR, Brown PO. 1997. Exploring the metabolic and genetic control of gene expression on a genomic scale. Science 278(5338): 680-686.

Very late activation during diauxic shift



Data source: DeRisi JL, Iyer VR, Brown PO. 1997. Exploring the metabolic and genetic control of gene expression on a genomic scale. Science 278(5338): 680-686.

Repression during diauxic shift



Data source: DeRisi JL, Iyer VR, Brown PO. 1997. Exploring the metabolic and genetic control of gene expression on a genomic scale. Science 278(5338): 680-686.