



IPA robustness analysis v1.2 (2020-07-07)

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July 1/3, 2020

For feedback or questions, please email bits@vib.be

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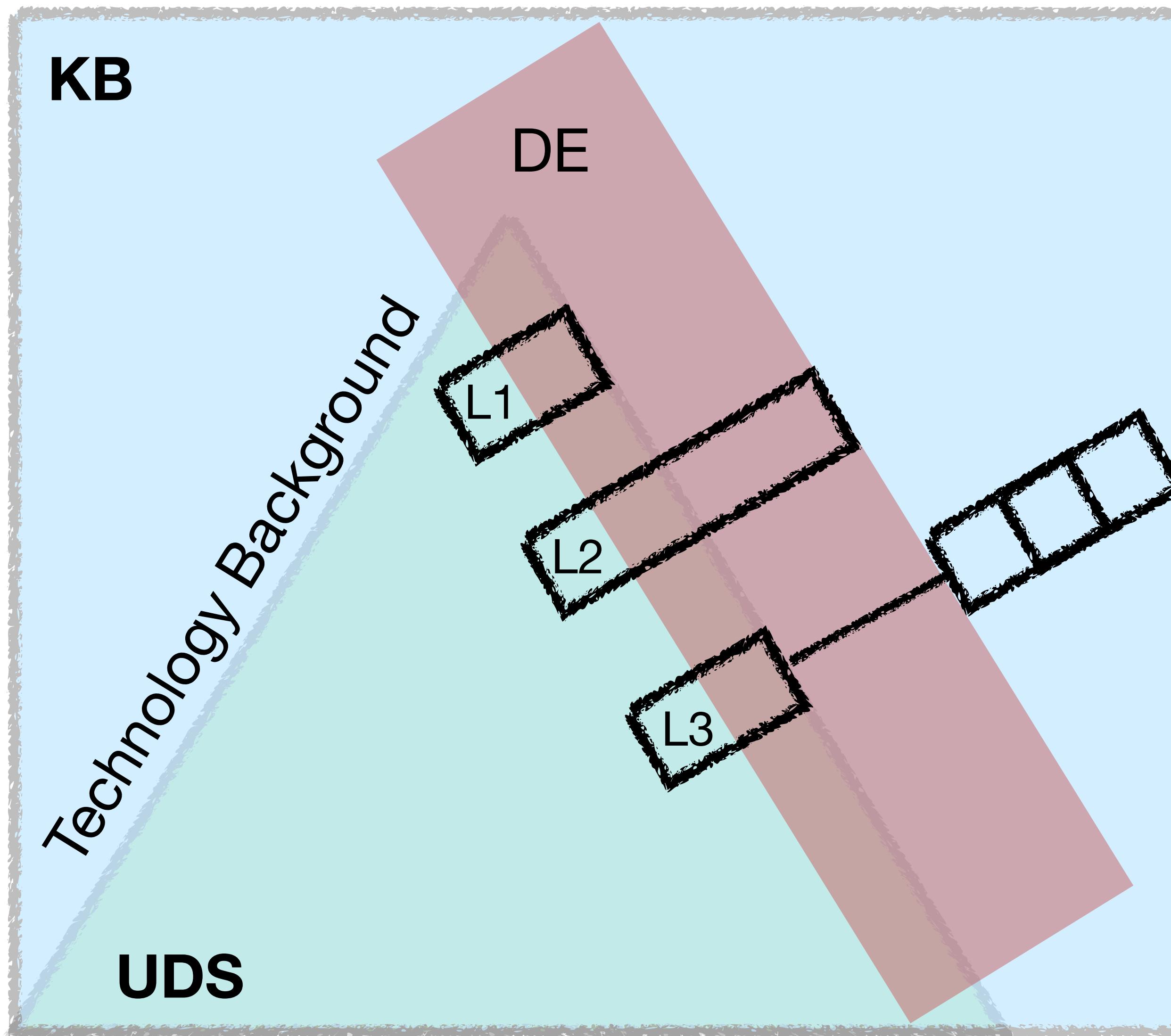


IPA robustness analyses

- applying different cutoffs to DE data
- data acquired with a low sensitivity technology
- data acquired with a low coverage technology
- Importance of the background

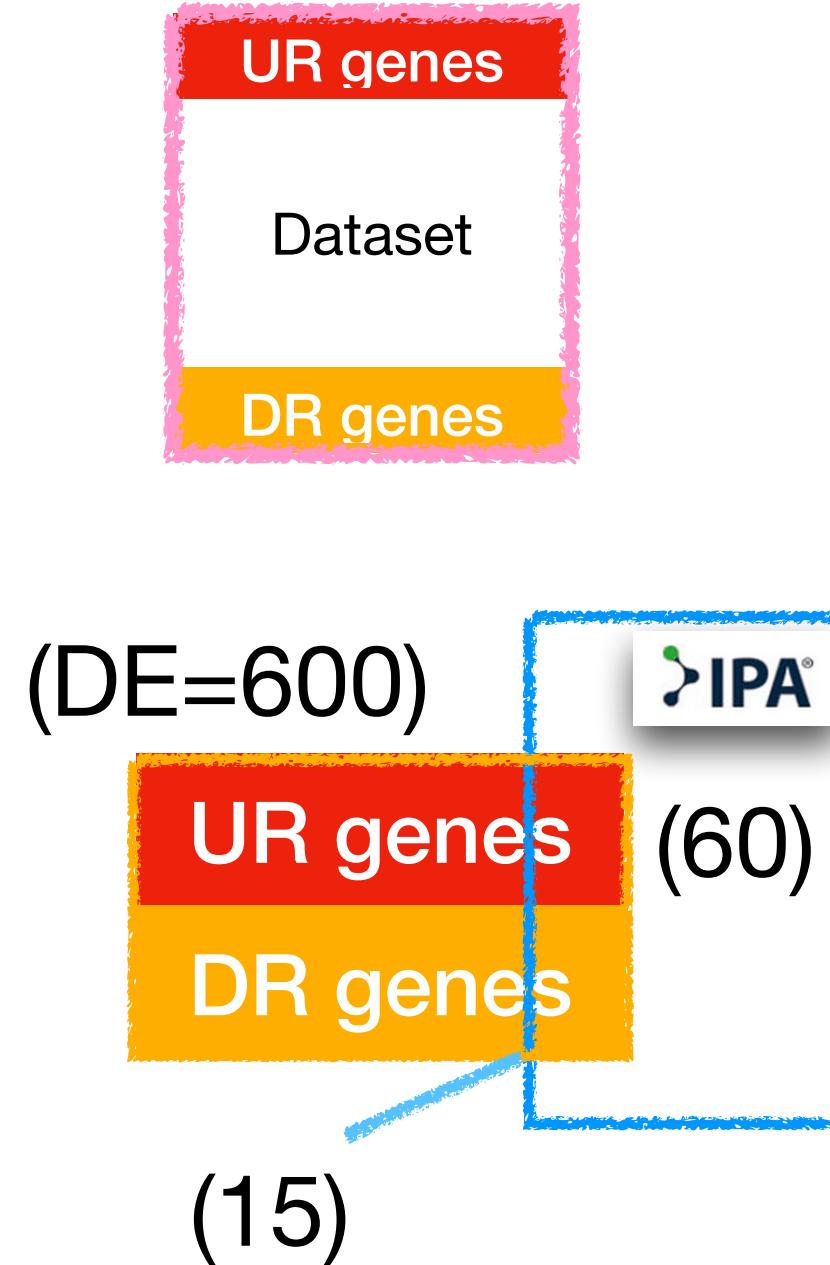
Background effect

Genome Background



| | UDS | KB | Effect |
|----|-----|-----|----------------------|
| L1 | 50% | 50% | = |
| L2 | 50% | 75% | <i>underestimate</i> |
| L3 | 50% | 20% | <i>overestimate</i> |

Simulation of a background & sampling effects



Part of the background is missed

| $k=600, n=15, M=60$ | |
|---------------------|--------------|
| Background | Enrich test* |
| IPA KB | 3.671516e-12 |
| 15k | 9.821754e-10 |
| 10k | 2.739608e-07 |
| 5k | 0.001280419 |

only 5 out of 15 DE are quantified

| $k=600, n=5, M=60$ | |
|--------------------|-------------|
| Background | Enrich test |
| IPA KB | 0.005716096 |
| 15k | 0.03180919 |
| 10k | 0.1469838 |
| 5k | 0.7344489 |

under-estimate

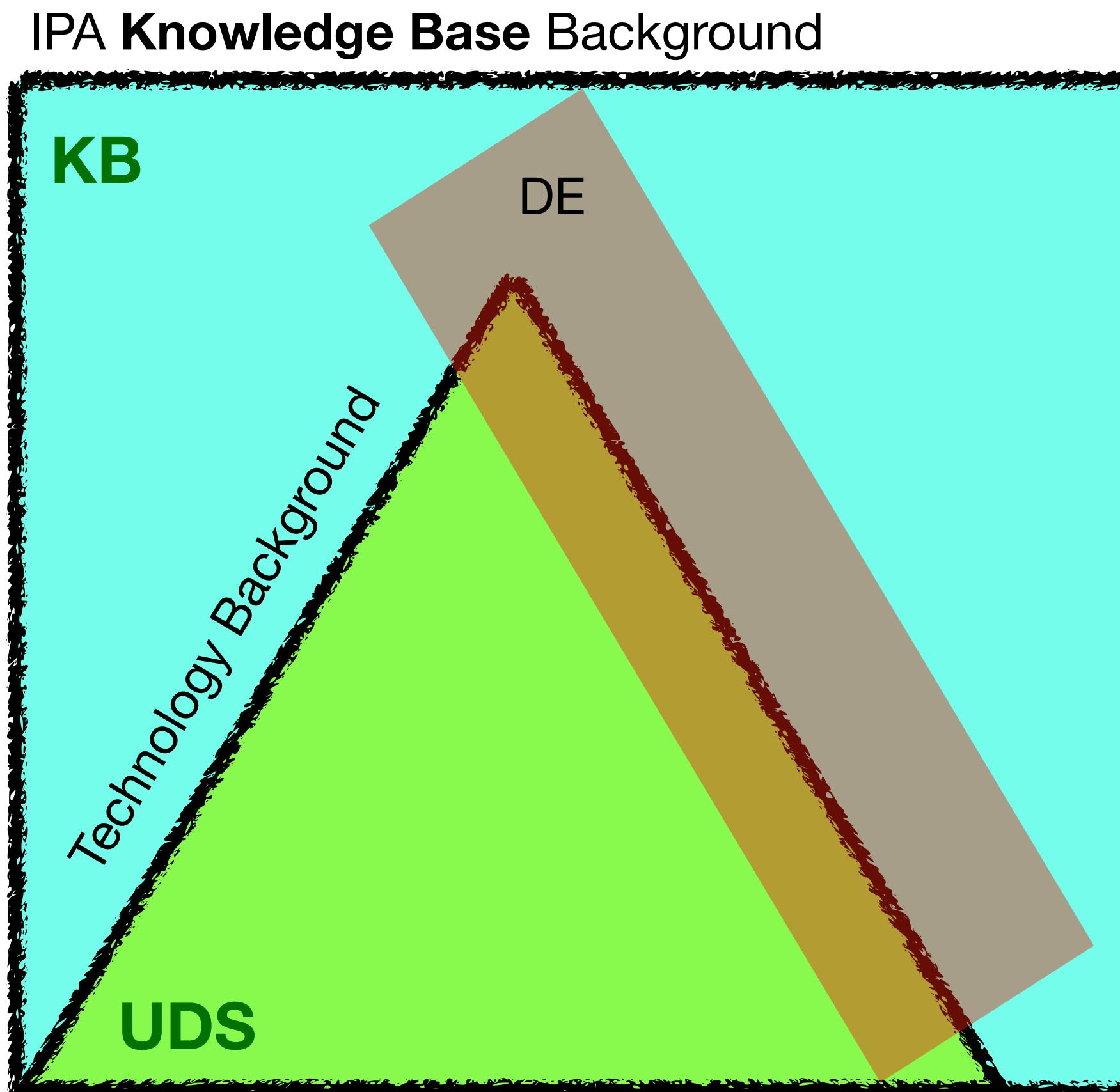
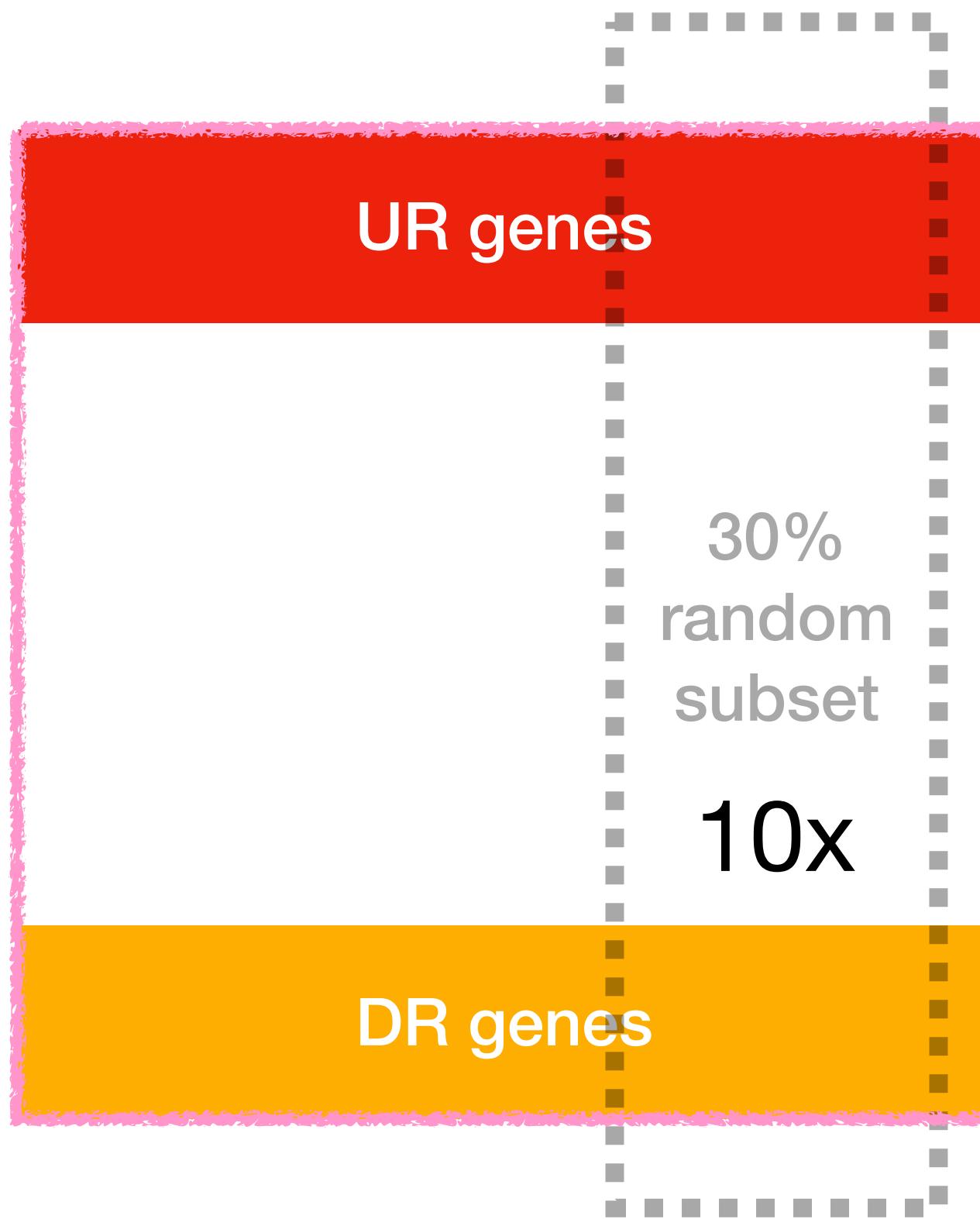
20 out of 60 from list are quantified

| $k=600, n=15, M=20$ | |
|---------------------|--------------|
| Background | Enrich test |
| IPA KB | 3.358551e-22 |
| 15k | 1.468597e-19 |
| 10k | 8.944017e-17 |
| 5k | 4.627636e-12 |

over-estimate

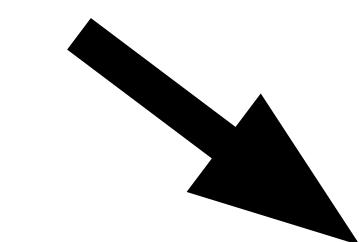
* $\text{phyper}(q, m, n, k, \text{lower.tail} = \text{FALSE}, \text{log.p} = \text{FALSE})$

Sampling x Background effect

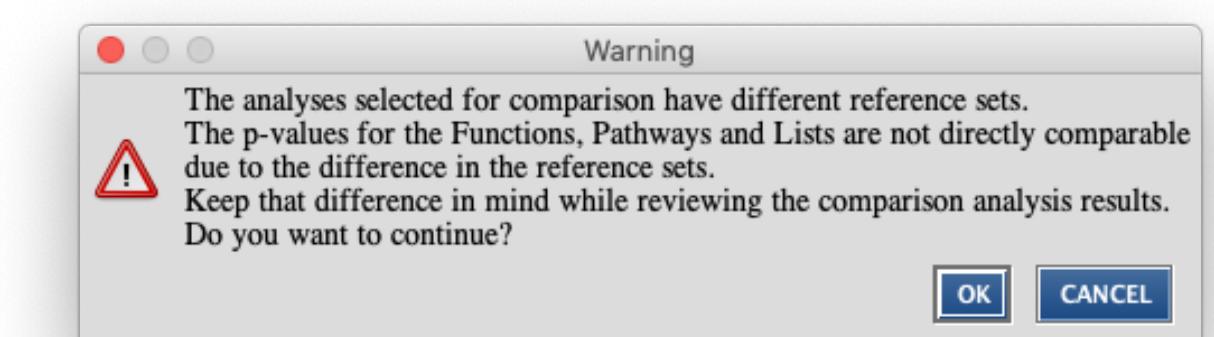


2x 10x core analysis
different backgrounds

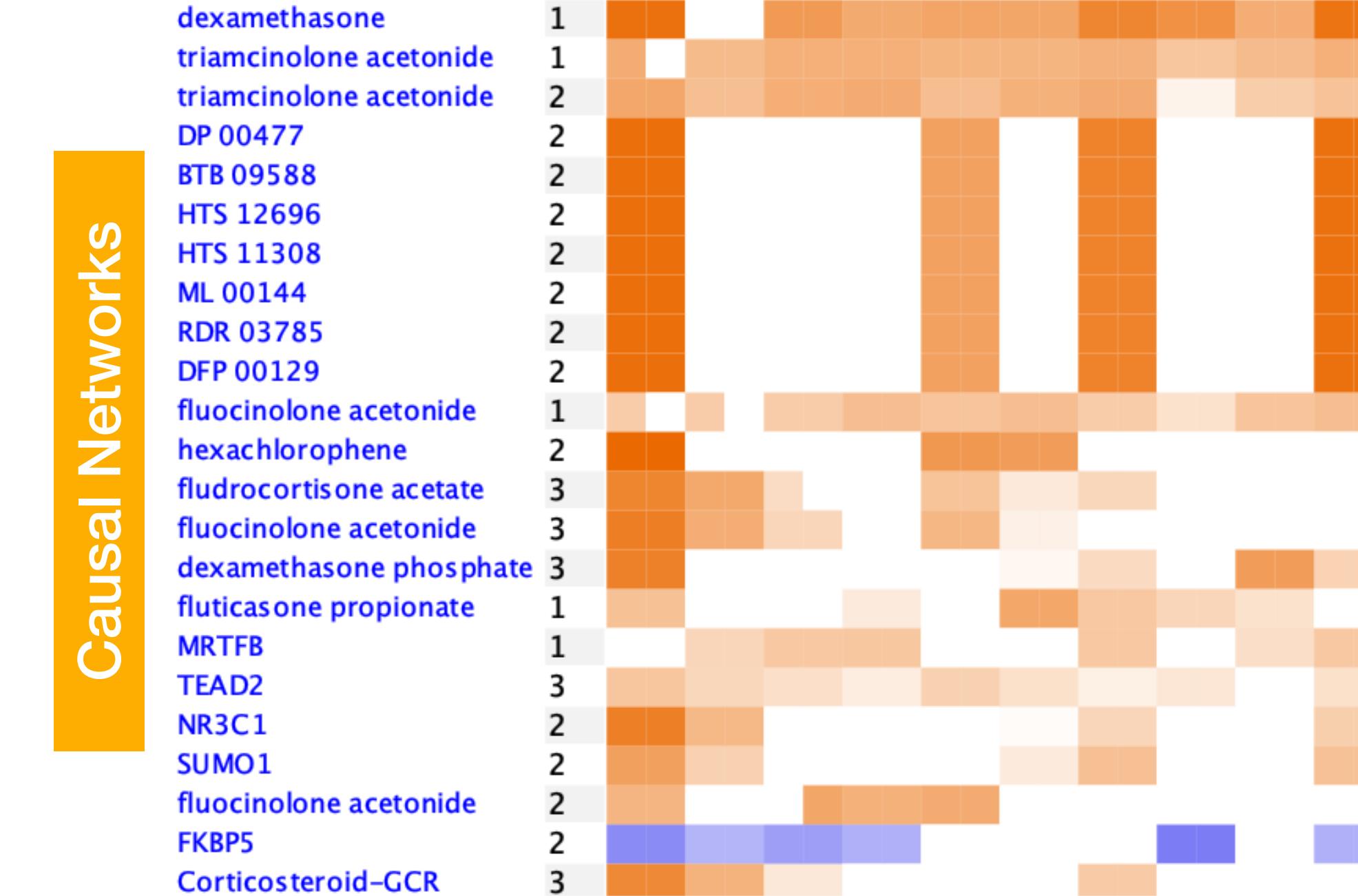
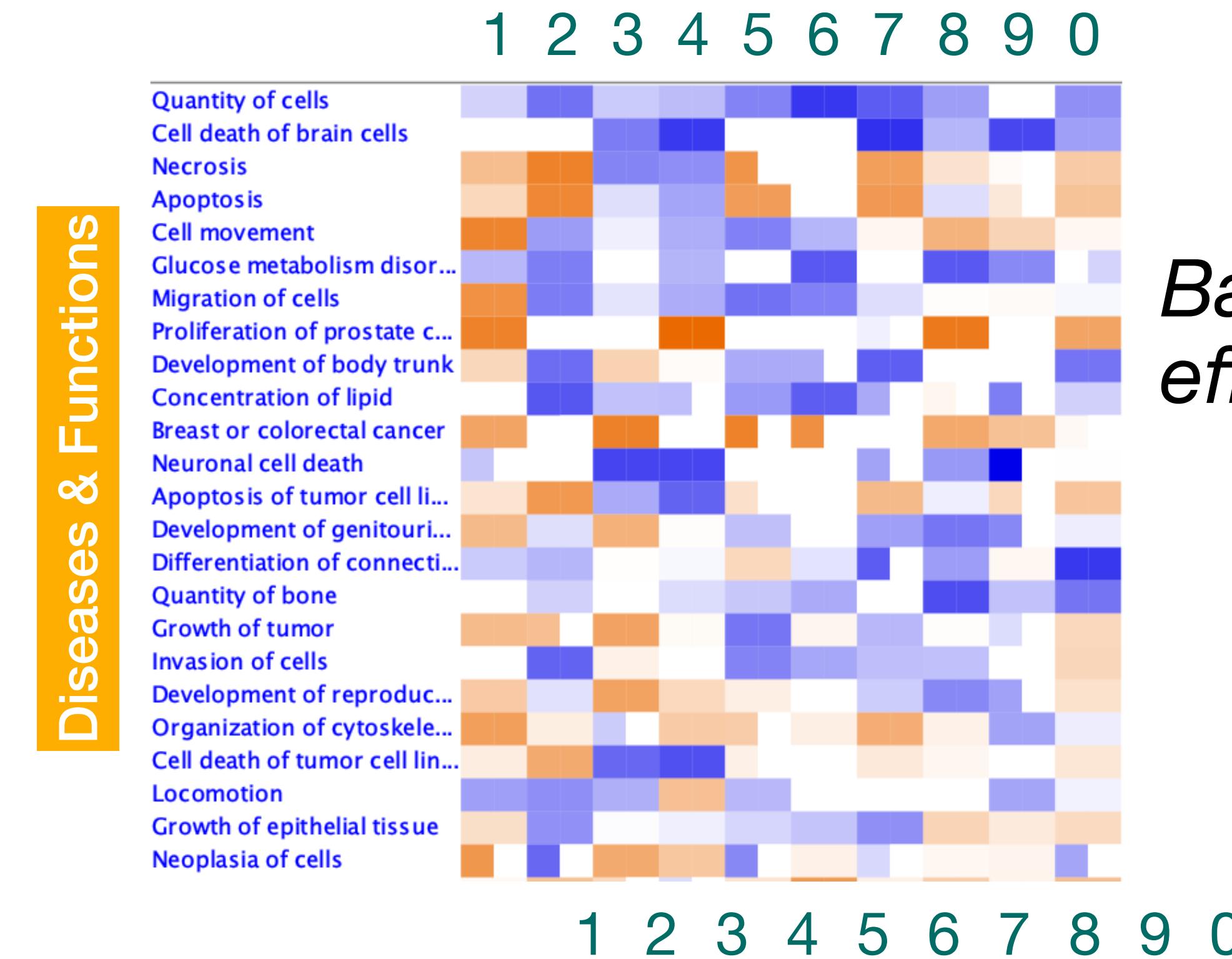
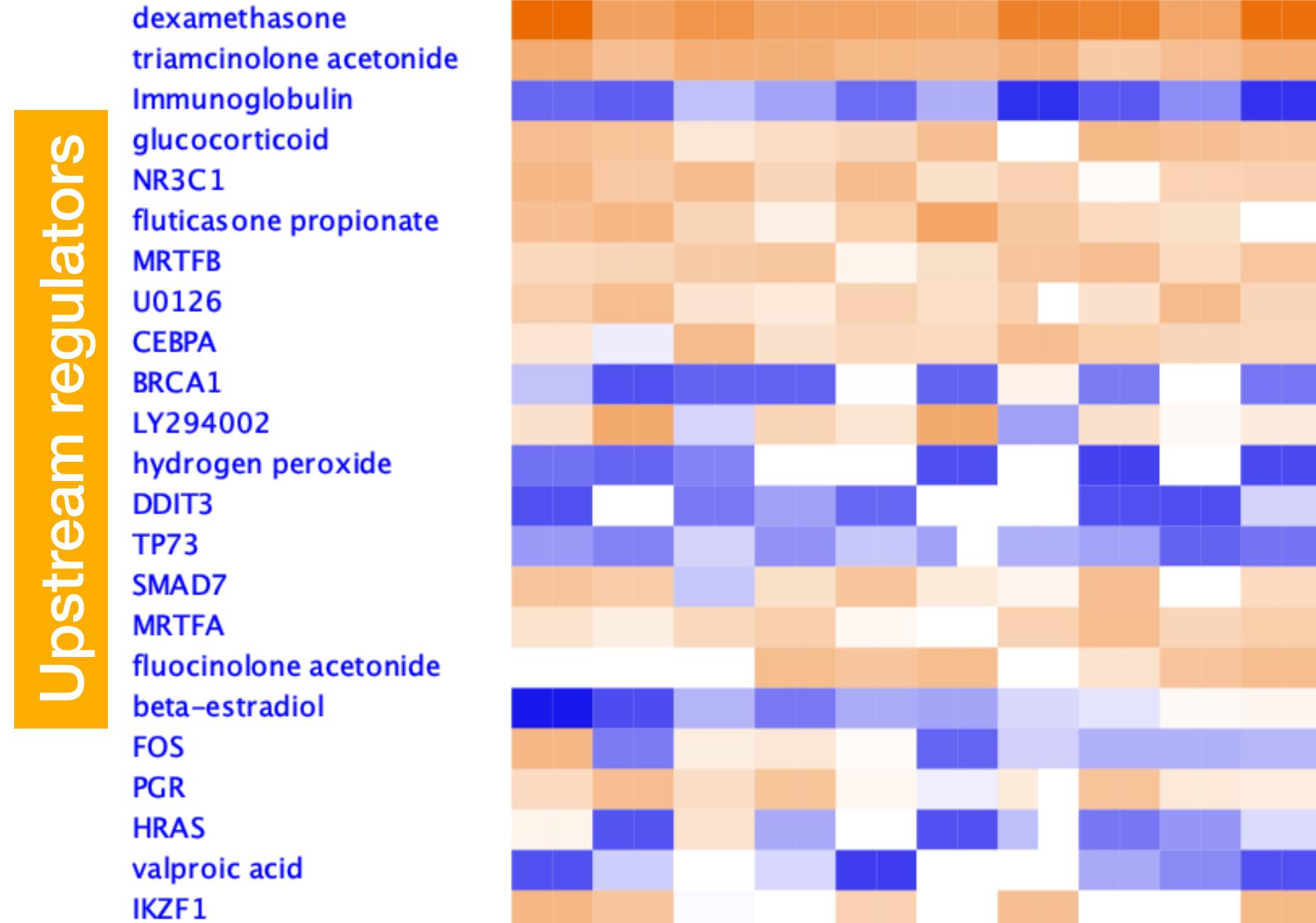
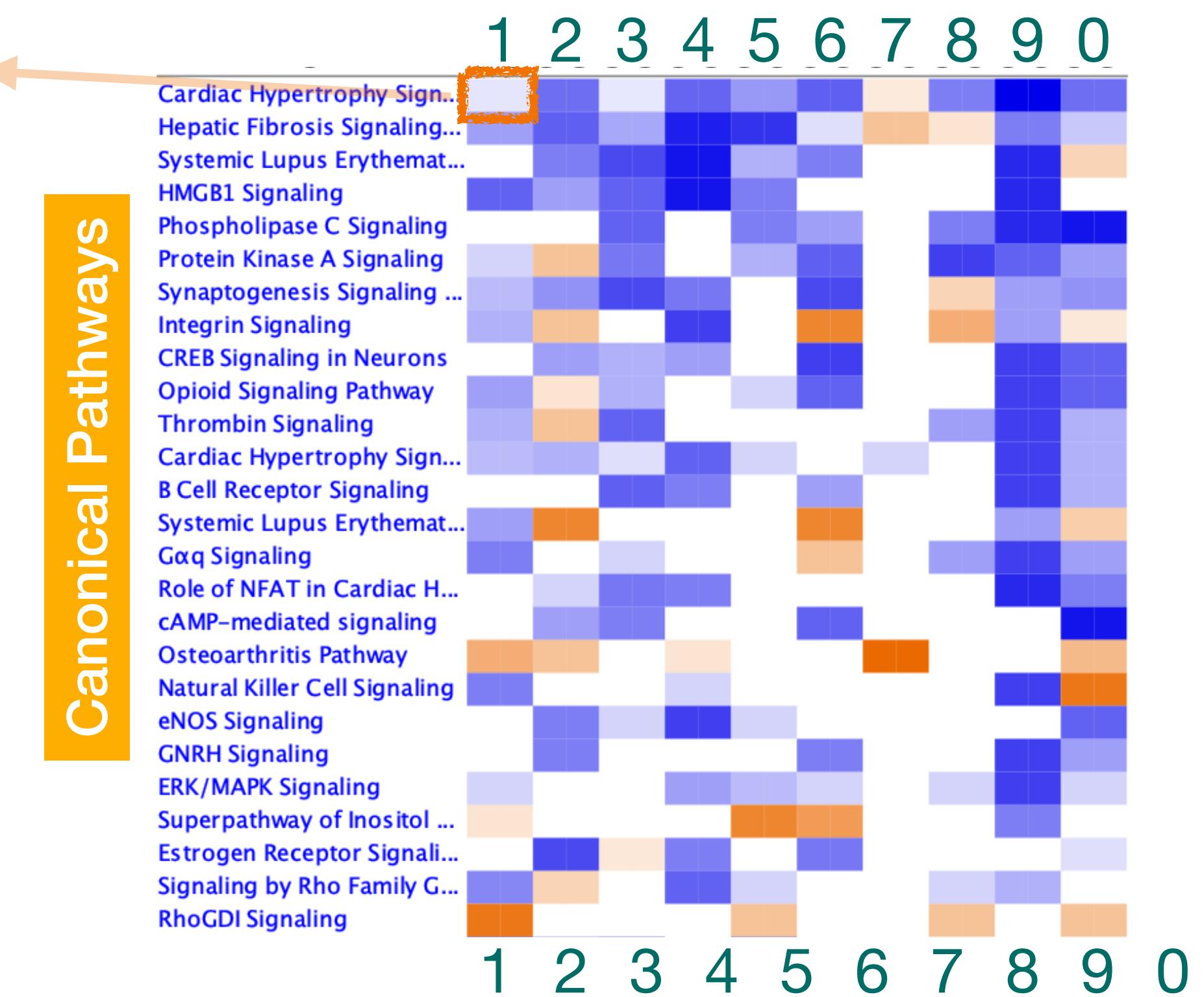
$|logR| > 1$ & $adjp < 0.001$



Compare

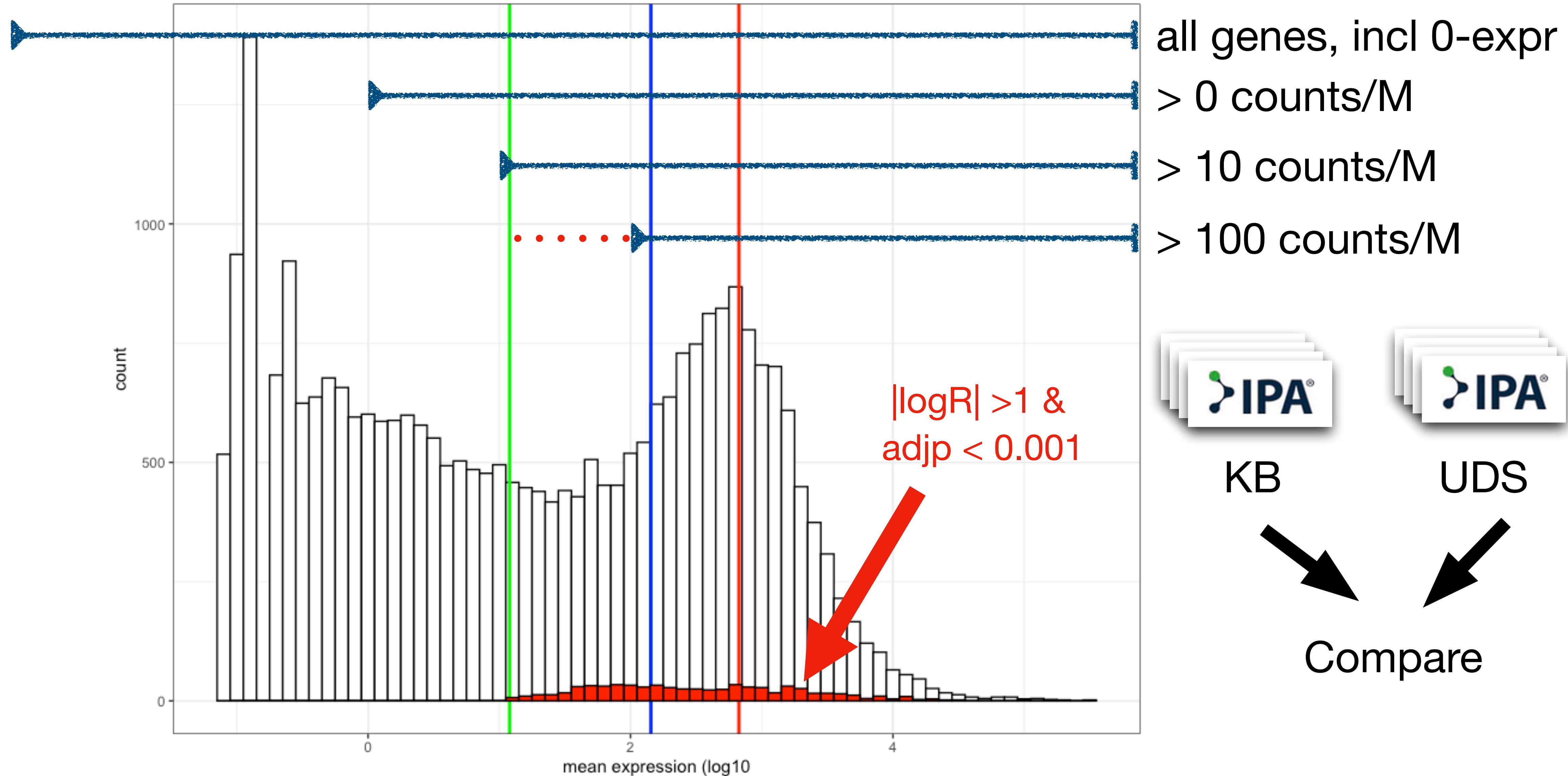


KB UDS

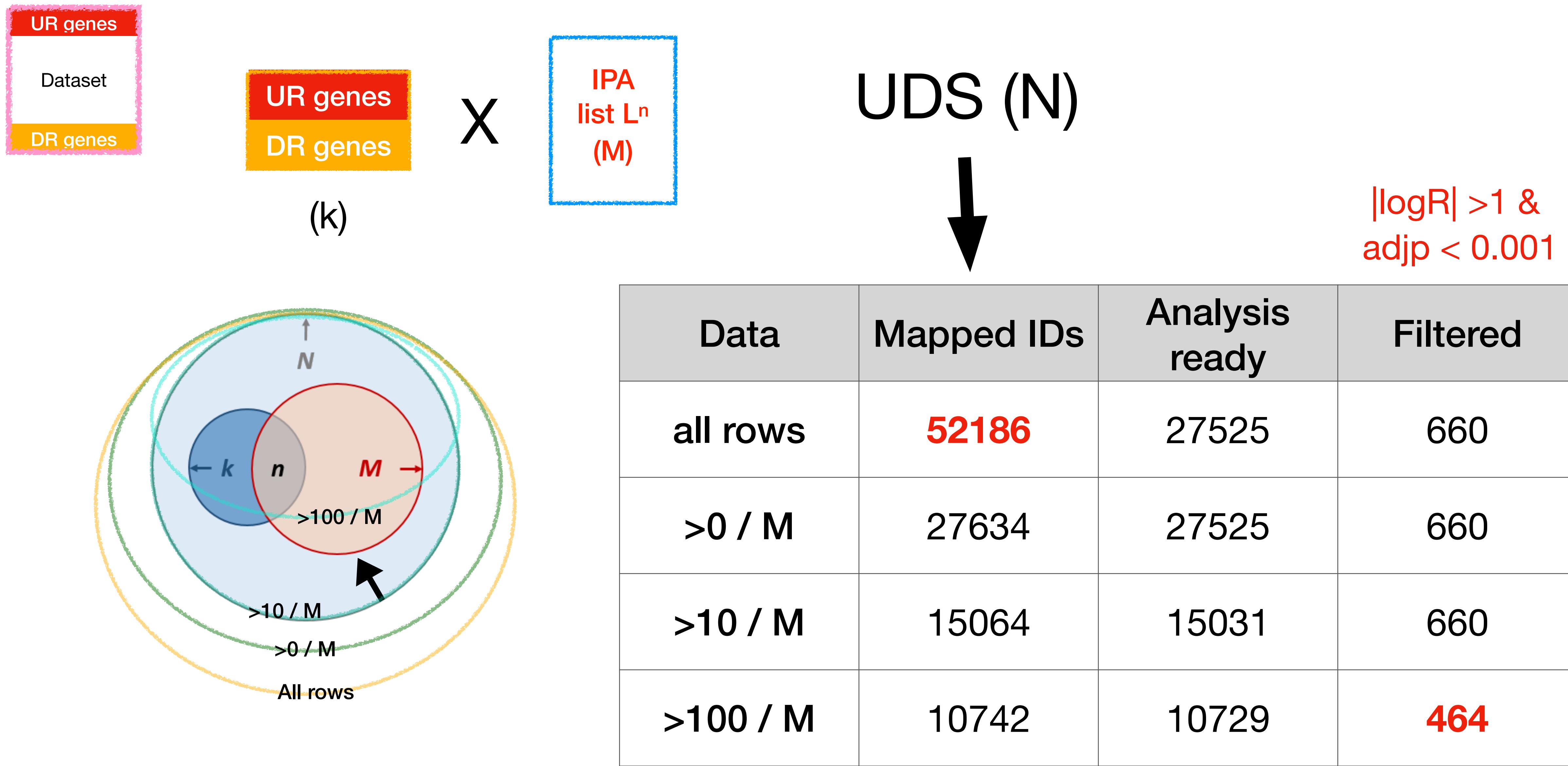


Background effect !

Background effects from low expression Tx

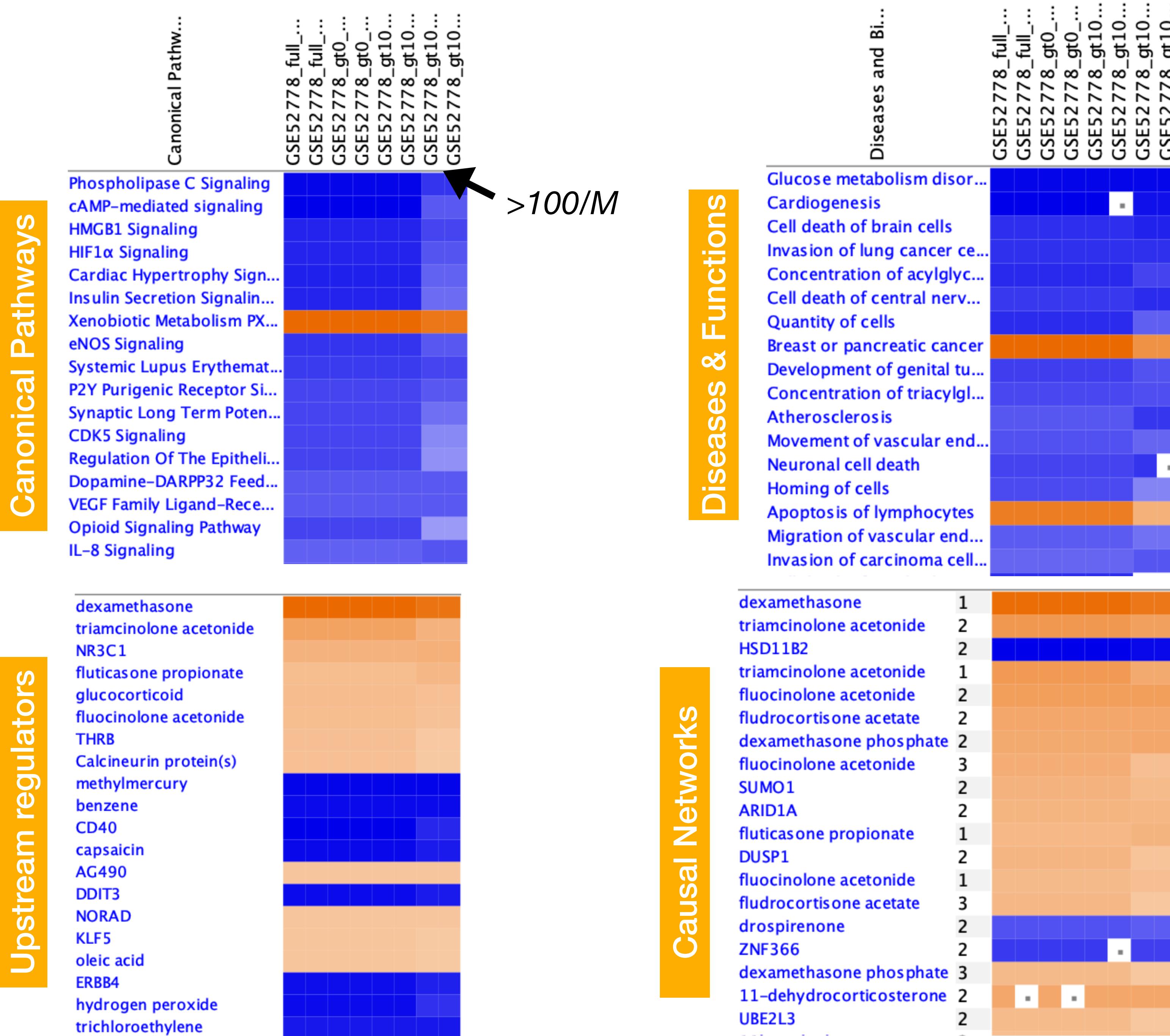


Effect of low-expression Tx on the UDS background size



* `phyper(q, m, n, k, lower.tail = FALSE, log.p = FALSE)`

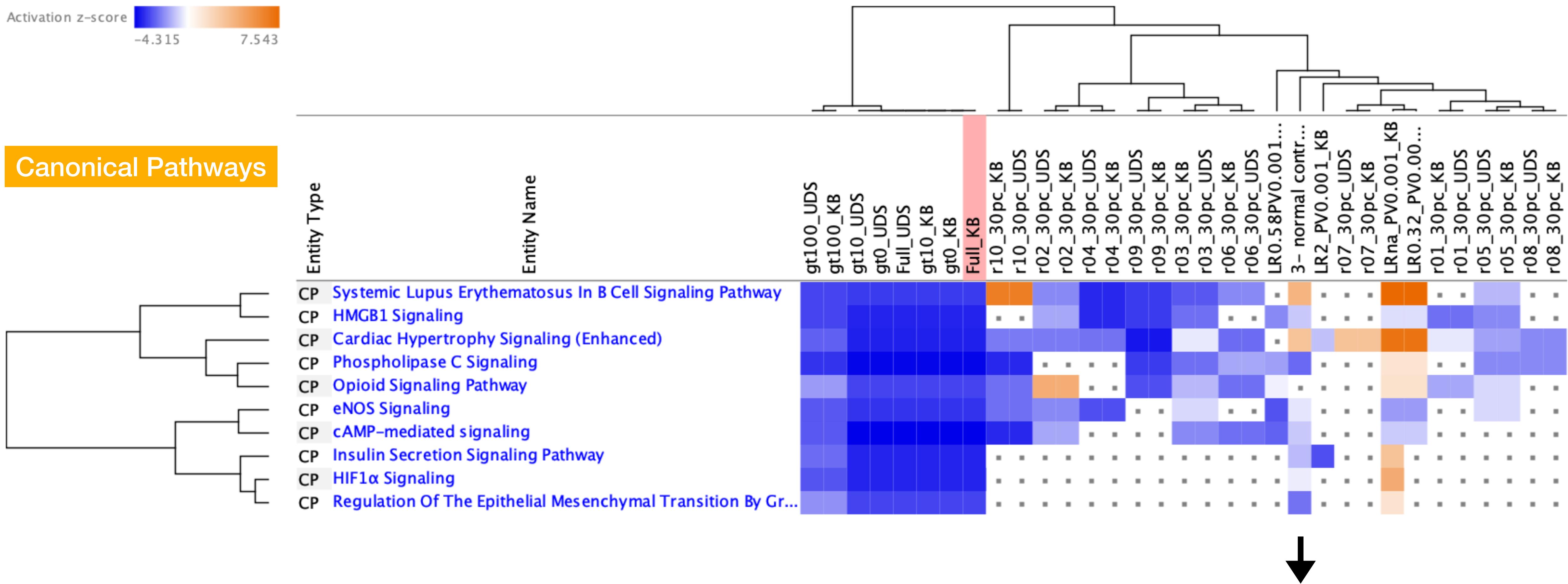
No clear
Background
effect
after
removing
low-ex
rows



IPA Global robustness results

- cutoff effects (LR, PV)
- sensitivity effects (top expressed genes (5k 10k 15k))
- sampling effects (30% random samples)
- background effects (removing low-expression Tx)

Global robustness results: Canonical Pathways

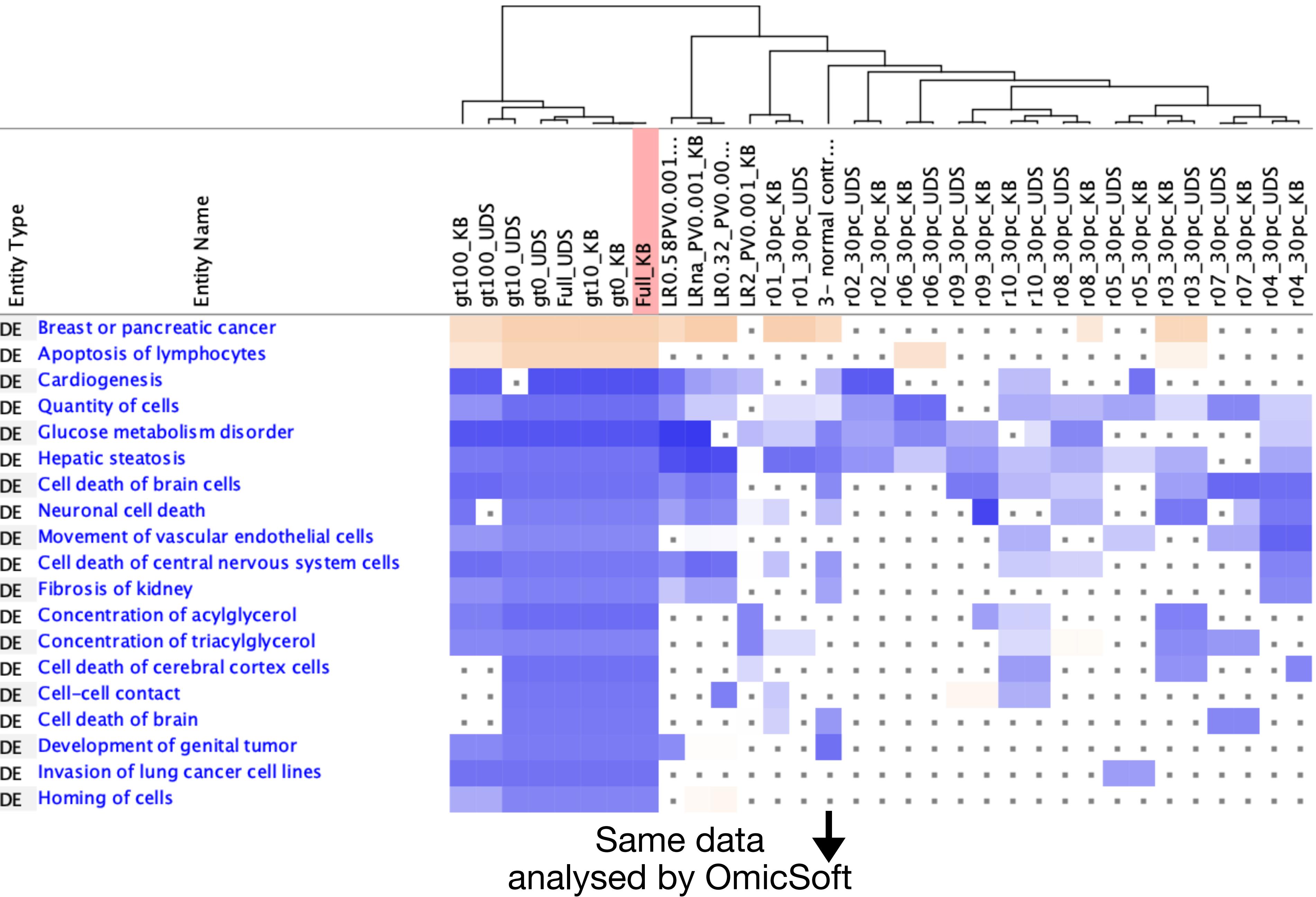
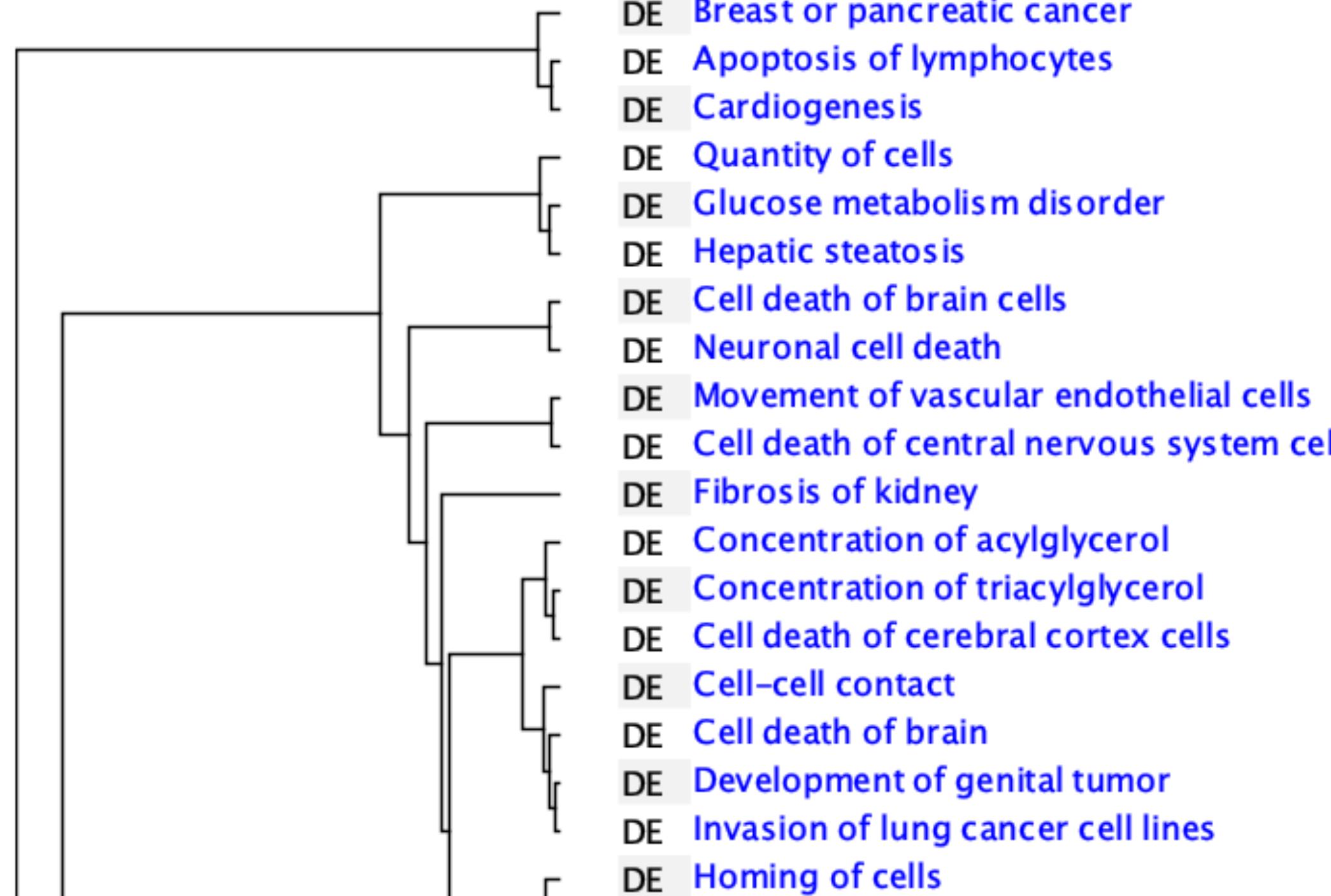


Same data
analysed by OmicSoft

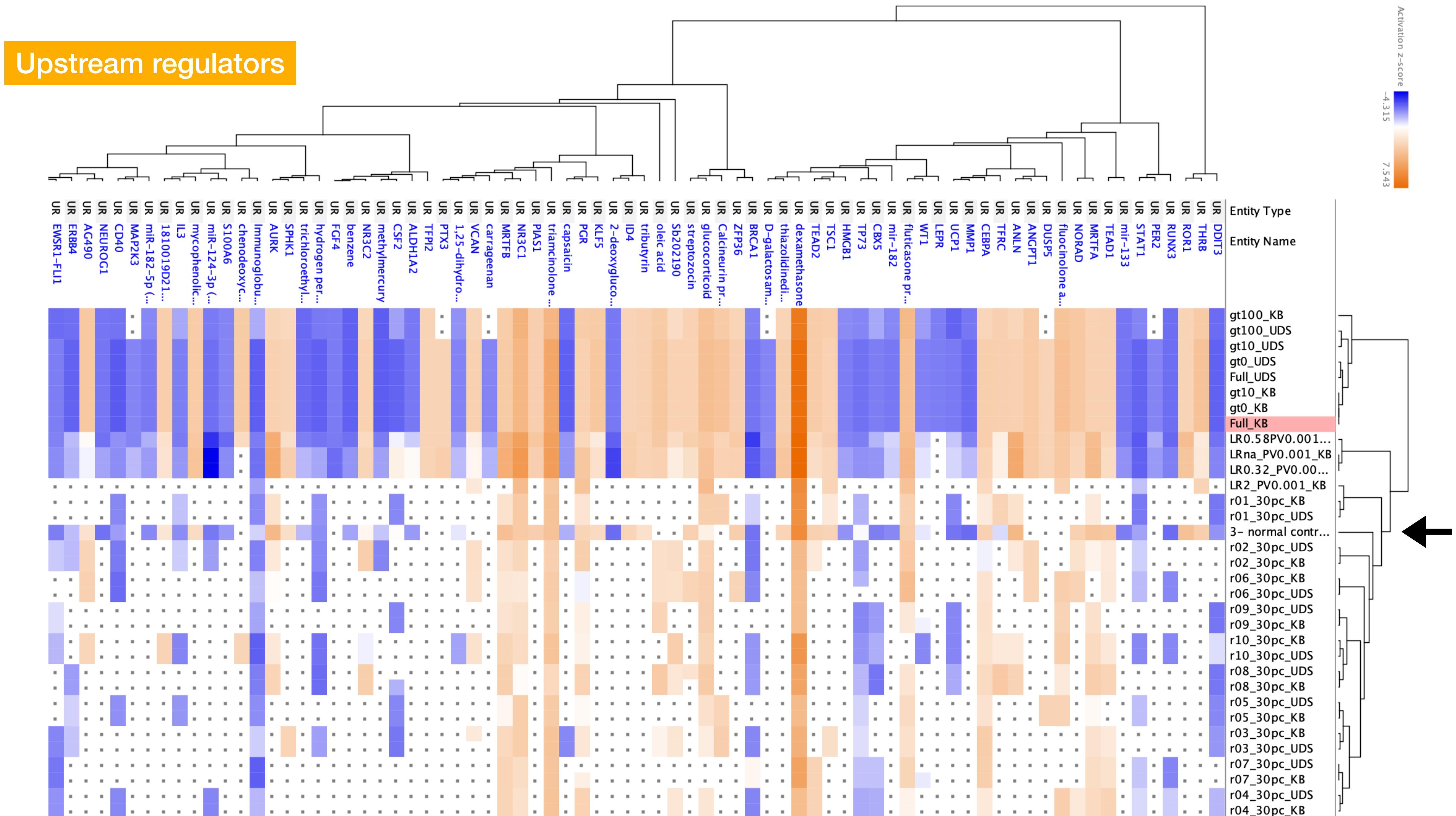
Global robustness results: Diseases & Functions



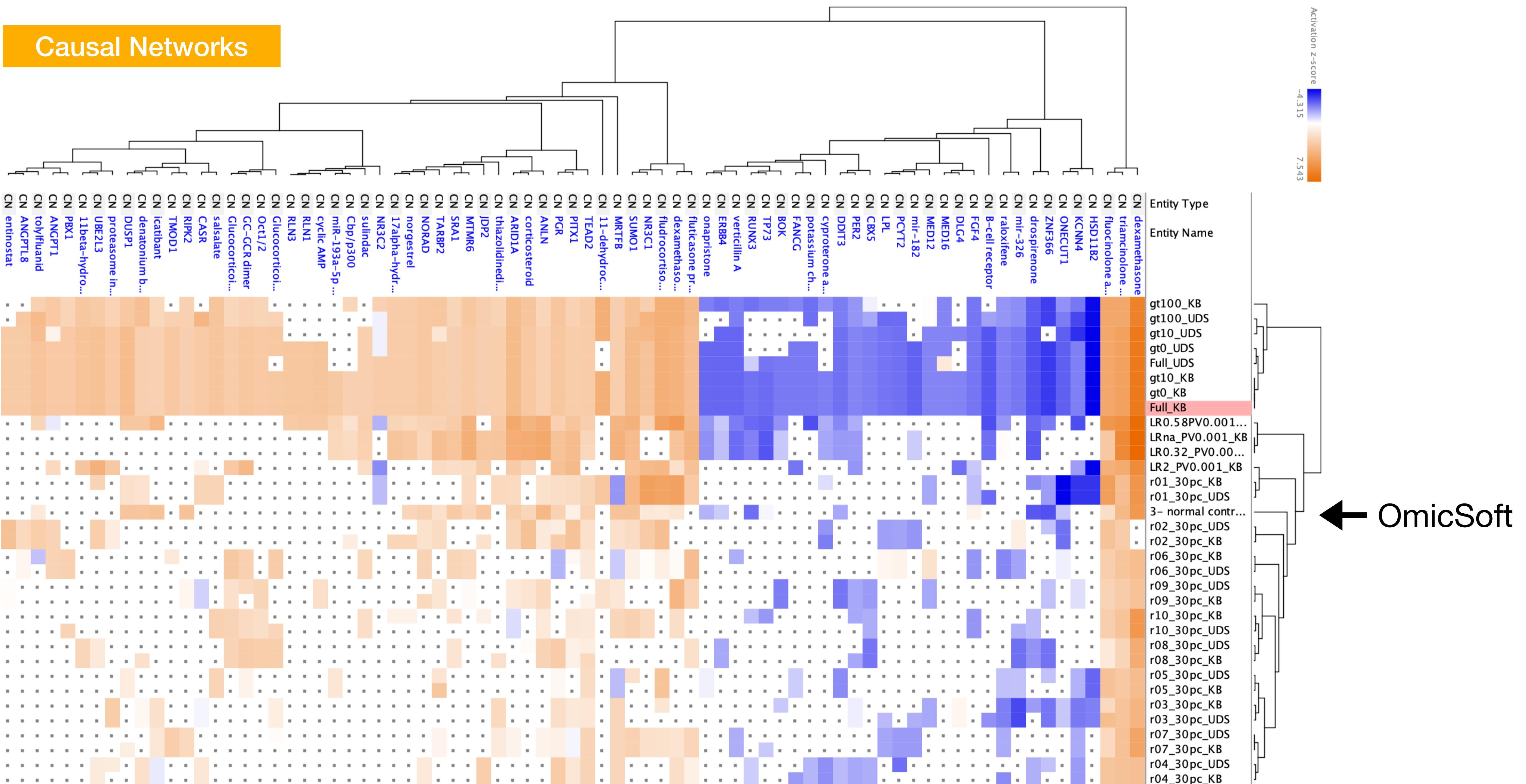
Diseases & Functions



Global robustness results: Upstream regulators



Global robustness results: Causal Networks



IPA

<https://www.bits.vib.be/software-overview/ingenuity-pathways-analysis>

bits.vib.be/software-overview/ingenuity-pathways-analysis

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Read the latest release notes ([here](#)).
Read the archived release notes ([here](#)).

Online Tutorials

Recorded IPA webinars and tutorial videos (in particular the 3-part series covering most of IPA)

Software Support

Overview

- > CLC Main Workbench
- > Tibco Spotfire
- > CLC Genomics Workbench
- > ELN
- > Genevestigator
- > GraphPad Prism
- > IPA
- > MATLAB
- > OpenRefine
- > qbase+
- > SnapGene
- > Galaxy
- > Developed@VIB
- > FlowJo

Software News