

Decrypting Patient-Specific Cell Signaling: Network-Based Strategies for Personalized Insights



Challenge

- Cell signaling networks orchestrate cellular responses to both normal and pathological stimuli.
- These intricate networks are wired in a context and patient-specific manner, depending on cellular identity, state and environment, in order to elicit an appropriate response.
- Their deregulation can lead to the development and propagation of diseases (e.g. cancer), facilitate viral proliferation or induce resistance to therapies, inter alia.
- While large-scale datasets derived from thousands of patients, tissues, cell types and conditions provide useful maps of cell processes, they fall short in capturing these context-specific variations in signaling pathways, their functions and cross-talks.


Technology (TRL8)

In our laboratory, we employ data-driven strategies to decode the rules governing context-specific human cell signalling responses and rewiring under various conditions and perturbations. We integrate diverse data types, including omics, (proteomics, transcriptomics), and imaging data, to construct networks and executable models that represent specific phenotypes of interest in various contexts. These models facilitate the identification of critical molecular drivers behind these phenotypes and the corresponding cellular signatures.

One of our goals is to elucidate the dynamic relationship between cell state and signalling behaviours. Our context-specific dissection of signalling networks reveals their intricate dependencies and the key regulatory nodes that govern specific phenotypes. Using Network Propagation or other network analysis methods, we identify active modules of cell signalling that drive changes in disease trajectory or phenotypes. These active modules include disease-associated genes, providing functional interpretations of large-scale multiomics datasets. In the case of cancer, our assessment of cellular morphology and omics data helps to distinguish between "favourable" and "unfavourable" cell shapes for prognostication. Our tools are modular and can be assembled into data-driven workflows to unveil disease signatures and predict the best treatment options based on the specific patient context. Our technology is designed to be user-friendly and customizable, with the potential for users to receive training in using the software, adjusting parameters, and understanding the ensued analysis.

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Internal EMBLEM Reference

2024-013

Key Inventors

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Applications

- **Personalized medicine:** Identification of disease signature; Definition of patient-specific treatment plans; Corrected targeted therapies and immunotherapies; Development of patients' digital twins; Drug response prediction; Optimizing treatment regimens; ...
- **Healthcare:** Enhanced patient stratification; Disease prediction and risk management; ...
- **Pharmacogenomics:** Personalize medication choices and dosages; ...
- **Pharmacology:** Drug target identification; Biomarker discovery;

Keywords

- # Precision medicine
- # Patient-specific cell signalling
- # Disease signature
- # Epigenetic
- # Single cell data analysis
- # Data-driven models
- # Multimodal data integration
- # Omics data
- # Functional analysis

Software

- [CEN-tools¹](#)
- [phuEGO²](#)

Benefits

- Community empowerment
- Resource enrichment
- Multimodal data integration
- Flexible and comprehensive models
- Modular and versatile workflow
- Accessible methods

Further Reading

- [1] <https://doi.org/10.15252/msb.20209698>
- [2] <https://doi.org/10.1101/2023.08.07.552249>
- [3] <https://doi.org/10.1016/j.gde.2019.05.001>
- [4] <https://doi.org/10.1101/gr.276059.121>

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Intellectual Property

- Know-how based
- Copyright

Commercial Opportunity

Our adaptable workflow explores context-specific human cell signaling to unveil the key elements influencing the phenotype. This insight enables informed decisions for patients, optimizing their care. Our services are accessible to everyone. We offer special rates for academics and SMEs. Contact us for collaborations.

Seeking:

- Collaborations
- Commercial partner
- Licensing

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